AUTOMOTIVE INDUSTRIES

A CHILTON PUBLICATION

NOVEMBER 15, 1960

Features • • •

PRODUCTION OF THE TEMPEST DRIVESHAFT

MAKING CADILLAC STEERING KNUCKLES

MODERN STEELS FOR LIGHTER AUTOMOBILES

LATEST DEVELOPMENTS AT LONDON MOTOR SHOW



Production Methods for 1961 Cadillac

Fred H. Cowin, staff engineer of Frame, Suspension and Steering, and E. Duane Solms, director of Reliability, check a front suspension system on chassis assembly line at the Cadillac factory

PAGE 60

ENGINEERING
MANAGEMENT • • PRODUCTION
DESIGN

NEW Model 322-A Bore-Matic

new industry-standard design provides

- ✓HIGHER PRECISION
- ✓EASIER SETUPS
- ✓LOWER MAINTENANCE COSTS



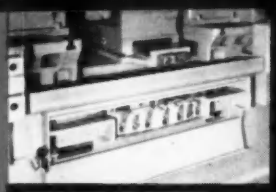
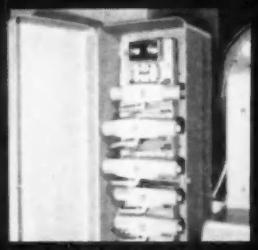


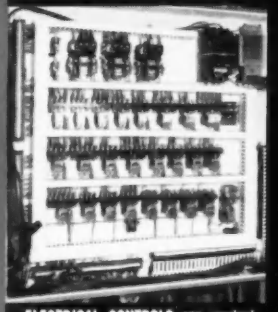
TABLE CAMS AND SWITCHES are enclosed for protection yet easily accessible for adjustment.



STANDARD SOLENOID VALVES are externally mounted, oil immersed and individually replaceable.



EXTERNAL HYDRAULIC POWER UNIT keeps accuracy-destroying heat out of the base, is readily accessible and isolates pump and motor vibration from the machine.



ELECTRICAL CONTROLS are centralized in an easily accessible dust-tight cabinet at the rear of the machine.

Completely new from base to bridge, this double-end Bore-Matic meets all JIC standards—gives you new precision and economy for high production Borizing of medium to large size work.

Hydraulic valves and power unit are outside of the base, preventing thermal distortion, providing maximum accessibility and contributing to sustained high precision. Control valves, mounted on hydraulic manifold plates at each end of the machine, are of standard, interchangeable design, easily accessible and individually replaceable. Bridge setbacks are infinitely adjustable on slotted pads, permitting optimum relationship between work and tooling. And a full-length table pad increases the capacity of the machine.

For complete information on all the time-saving, labor-saving features of this versatile new machine, just call your Heald engineer, or send for Bulletin No: 2-322A.

PRECISION ROTARY INDEXING FIXTURE.

Shown on the machine above is a new electronically-controlled rotary indexing fixture, adjustable for any desired number of equally-spaced indexes from 4 to 500,000, permitting precision drilling or boring of accurately-spaced holes on one or more bolt circles. Holes with the same spacing are Borized in a fully automatic cycle, resetting the controls only when spacing is changed.

It PAYS to come to Heald

THE HEALD MACHINE COMPANY

Subsidiary of The Cincinnati Milling Machine Co.

Worcester 6, Massachusetts

Chicago • Cleveland • Dayton • Detroit • Indianapolis • Lansing • Milwaukee • New York • Philadelphia • Syracuse

HEALD

Circle 101 on Inquiry Card for more data

KNOW YOUR ALLOY STEELS . . .

This is one of a series of advertisements dealing with basic facts about alloy steels. Though much of the information is elementary, we believe it will be of interest to many who may find it useful to review fundamentals from time to time.

Determining the Depth-Hardness of Alloy Steels

The hardenability of an alloy steel is usually measured by the depth to which the steel will harden under specific conditions of heating and cooling. One of the most conclusive methods of determining depth hardness is the end-quench hardenability test (ASTM A255). In essence, this test is as follows:

A 1-in. round specimen, approximately 4 in. long, is heated uniformly to the proper quenching temperature. The specimen is removed from the furnace and placed in a bracket; then a jet of water at room temperature is played on the bottom face of the specimen without touching the sides. This water jet is kept active until the entire specimen has cooled. Longitudinal flat areas are ground on opposite sides of the piece, and Rockwell C readings are taken at 1/16-in. intervals. The resulting data are plotted on graph paper, with the Rockwell C values as ordinates and distances from the quenched end as abscissae.

Experiments have shown that the points on the hardenability curve approximate the cooling rates at the centers of quenched rounds of various sizes; and that the hardness values at the centers of these rounds will correspond very closely with those shown at points on the end-quench hardenability curve.

In general it may be said that when end-quench curves for different steels approximately coincide, these steels can be treated similarly for equivalent tensile properties in sections of the same size.

A study of hardenability curves reveals that depth-hardness depends upon the amount of carbon present, the alloy content, and the grain size. Manganese, chromium, and molybdenum are the chief elements that promote depth-hardness, while nickel and silicon help to a lesser degree. It should be noted, also, that phosphorus promotes depth-hardness, while sulphur has a negative effect. In normal low-phosphorus and low-sulphur steels, the two elements neutralize each other.

This series of alloy steel advertisements is now available as a compact booklet, "Quick Facts about Alloy Steels." If you would like a free copy, please address your request to Publications Department, Bethlehem Steel Company, Bethlehem, Pa.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
Export Sales: Bethlehem Steel Export Corporation

BETHLEHEM STEEL



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TO

MINIMIZE PRODUCTION COSTS

SPECIFY

B&W *Job-Matched seamless mechanical tubing*

Only through B&W can you get . . .

- such a wide selection of tubing from which to choose
- unbiased assistance in the choice of the type of tube for a given application

Service is only one of the many reasons why it pays to specify B&W Seamless Mechanical Tubing. And remember matching tubes to jobs assures you of ease of fabrication and a better product at optimum low unit cost. For more information call your local B&W District Sales Office or write for Bulletin TB-361. B&W Mechanical Tubing is also available through a nationwide network of independent Steel Service Centers. The Babcock & Wilcox Company, Tubular Products Division, Beaver Falls, Pennsylvania.

Steel

B&W

THE BABCOCK & WILCOX COMPANY

TUBULAR PRODUCTS DIVISION

TA-9048-SM2

Seamless and welded tubular products, solid extrusions, seamless welding fittings and forged steel flanges—in carbon, alloy and stainless steels and special metals

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AUTOMOTIVE INDUSTRIES

A CHILTON MAGAZINE • PUBLISHED SEMI-MONTHLY

NOVEMBER 15, 1960

Passenger Cars • Trucks • Buses • Aircraft • Tractors • Engines • Bodies • Trailers • Road Machinery • Farm Machinery • Parts and Components • Accessories • Production and Processing Equipment • Design • Production • Engineering • Management

VOL. 123, No. 10

Features

Production of the Tempest Driveshaft
The long, slender torsion bar driveshaft of the Pontiac Tempest requires special manufacturing techniques. These are described in a four-page article. Page 55

How Bendix-Westinghouse Tests Diaphragms for Air Brakes
To assure maximum reliability, Bendix-Westinghouse subjects a fabric considered for an air-brake diaphram to extremely severe tests. Page 59

Latest Production Techniques at Cadillac
New techniques employed in making steering knuckles and in assembling instrument panels are described and illustrated in a four-page article. Page 60

Modern Steels for Lighter Cars
Some of the newer steels now available have 1½ to over 3 times the strength of carbon steel. Their use in automobiles to reduce weight is discussed, and a number of examples are given. Page 64

London Motor Show
There were 360 models displayed by 33 British companies and 37 manufacturers from nine other countries at the London Motor Show. Page 68

Czech Plant Tooling for Rear-Engined Car
Czechoslovakia's principal automobile plant is retooling its plant and has an output, at the present time, of 210 cars and chassis per day. Page 70

Showing the Quality Picture—The Histogram
A method of quality control, machine evaluation, etc., which can be readily understood by shop personnel, is described. Page 72

Digital Computer Used in Design of Army Truck
At the Detroit Arsenal, everyday use is made of computer equipment for the evalution and designing of future vehicles. Page 74

Selecting Proper Cutting Fluids
Cutting fluid is one of the keys to successful chip production. Some of the problems in its selection, and the answers, are presented here. Page 78

Ignition Performance Conference
Spark plug fouling, pre-ignition, misfiring, and cross firing were among the subjects at the Second Ignition Performance Conference sponsored by the Champion Spark Plug Co. Page 80

SAE National Aeronautic Meeting
This year's event included an Air Force Astronautic Symposium and an Aerospace Manufacturing Forum. Page 96

16 New Product Items and Other Features Such as:
Machinery News; Manufacturers' News; and Industry Statistics.

. . . continued on next page

MEMBER

SBME Society of Business Magazine Editors

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NBP National Business Publications, Inc.

BPA Business Publications Audit of Circulation

AUTOMOTIVE INDUSTRIES is a consolidation of The Automobile (weekly) and the Motor Review (weekly), May, 1902; Dealer and Repairman (monthly), October, 1903; the Automobile Magazine (monthly), July, 1907, and the Horseless Age (weekly), founded in 1895, May, 1918.

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Taylor Fibre Co. announces acquisition of

Dytronics
INCORPORATED • ROCHESTER, MICH.

Leading producer of die stamped circuits

Taylor Fibre Co., a leading manufacturer of laminated plastics and vulcanized fibre, has acquired Dytronics, Incorporated, a leading producer of die stamped circuits for the automotive, appliance, electrical and electronics industries.

Die stamped circuits are *printed circuits* produced by a dry technique in which a heated metal-cutting die is used to delineate the conductor pattern and bond it to the base material by activating a thermoresponsive adhesive between the metal foil and the insulating areas.

Here are some of the salient features of die stamped circuits that will give you big benefits:

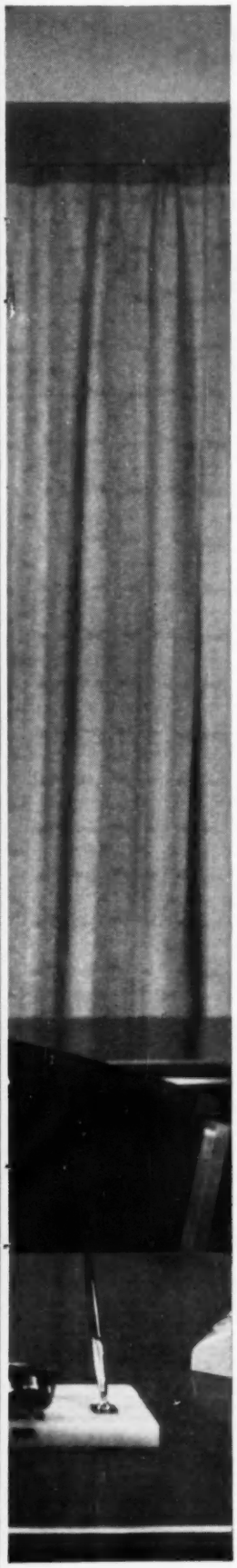
- **Unique base materials can be employed**
- **Electrical properties of the base materials are unimpaired during processing**
- **A greater variety of conductor metals can be used**
- **Uniformity of circuit configuration can be maintained indefinitely**
- **Exact duplication of circuit pattern is assured**
- **Exact line definition is provided**
- **Base material can be selected for electrical properties without consideration of chemical resistance**
- **Currents in excess of 40 amp can be handled**
- **Higher bond strengths can be produced**
- **High quality mass production is possible**

Send now for a copy of a new booklet we have prepared on Dytronics and die stamped circuits—you will be glad you did. Taylor Fibre Co., Norristown 49, Pa.

Taylor Fibre Co.
LAMINATED PLASTICS
VULCANIZED FIBRE

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THE AMPLEXOLOGIST



The Amplexologist occasionally gets more than he bargained for. But that's not bad. It's good. In fact, it's like hitting the jackpot on the 123rd try.

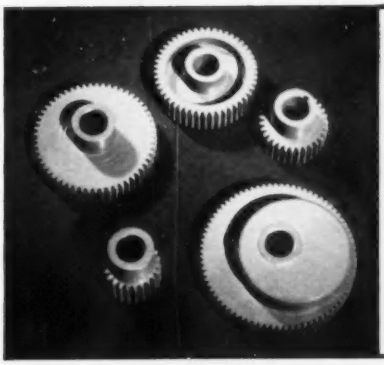
Why? Well, the Amplexologist has convinced any number of manufacturers that a few of the parts in their products can be made better and cheaper by eliminating machining costs through advanced powder metallurgy (i.e. Amplexology).

Strange to say, however, many of these same manufacturers are often hesitant about exploring the broad application of powder metallurgy to their product. Well, it takes time. But sooner or later most of them take the plunge:

O.K., Genius. Let's see how good you really are. Take all the prints for our new models. Check every one. Then you tell us how many parts can be made out of powder metal. And how much they'll cost.

You see? Jackpot. And not just for the Amplexologist. For the manufacturer, too. A cost saving jackpot . . . because he's starting when designs are still flexible to take full advantage of powder metallurgy.

Challenges like this (*"You tell us . . ."*) pay off for manufacturers and for us. They have in fact, helped make us the world's largest and most experienced producer of powder metal parts. Another reason why leading manufacturers say: **When it comes to powder metallurgy —Amplex has the answer.**



"You tell us . . ."

The parts shown are a new gear train: driver gear, high and intermediate speed driven gears, low speed gear, pinion gear. These five parts plus ten more were selected by the Amplexologist—who was called in at the design stage—for powder metal production. All are finished precision parts which require no machining (except the helical gear). Estimated savings on the gear train, 86%.

AMPLEXOLOGIST

SEND COUPON **. . . if you'd like to talk over your product with the Amplexologist. Don't hesitate. He's always happy to get out of the office.**

AMPLEX DIVISION • CHRYSLER CORP. • Dept. A-11
P.O. Box 2718 • DETROIT 31, MICH.

Please have the Amplexologist call to look into the possibility of using powder metal parts in our product.

NAME_____

COMPANY_____

ADDRESS_____

CITY_____ **STATE**_____

PRODUCT_____

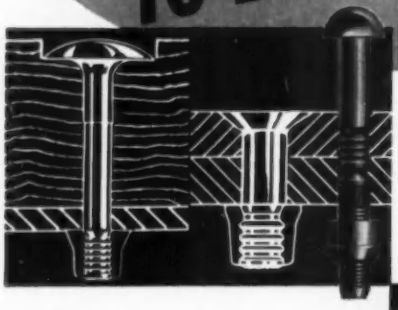
AMPLEX

DIVISION CHRYSLER CORP.

A CHRYSLER OILITE® PRODUCT

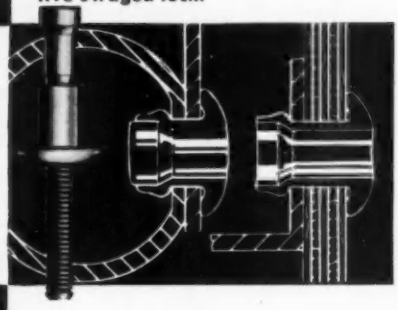
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ONLY HUCK OFFERS ALL FIVE WAYS TO LOWER ASSEMBLY COSTS.



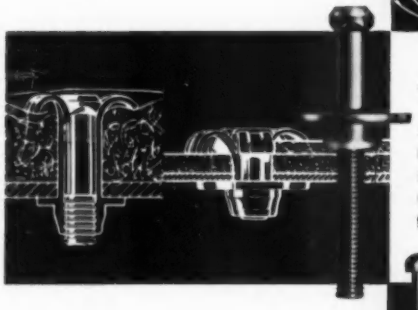
THE HUCKBOLT®

Engineered for soft core panels, wood, plastics, as well as metal-to-metal use. Complete assortment of headstyles for any application. Full range of sizes and materials. Great strength, positive swaged lock.



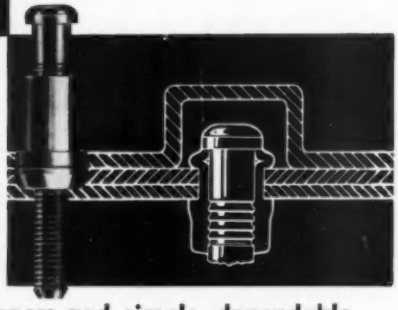
THE 9SP & PT

Low cost, blind fasteners for joining dissimilar materials, fast and easy to install. Solid core provides high shear strength or pulls through in PT to provide grommet hole.



THE DAISY®

A very broad bearing, wide grip range blind fastener for metal-to-metal or soft material use. Fast, uniform, economical. Has positive swaged lock.



THE OS

A structural blind rivet with aluminum alloy sleeve and pin. High clinch and shear strength. Wide bearing and self-sealing. Use in metal, plastics or wood.

Huck's complete line of fasteners and simple, dependable installation tools offer speed, uniformity and economy for most fastening operations. Every Huck fastener is carefully engineered for its job. Our experienced fastener engineers will gladly help you in selecting the best fastener for your use.

HUCK MANUFACTURING COMPANY

2480 Bellevue Avenue • Detroit 7, Michigan • Phone WA 3-4500

CALENDAR

OF COMING SHOWS AND MEETINGS

ASME, Winter Annual Meeting, New York .....Nov. 26-Dec. 1

ASME, Power and Mechanical Engineering show, New York Nov. 28-Dec. 2

National Exposition of Power and Mechanical Engineering, New York .....Nov. 28-Dec. 2

Semi-Annual Meeting, Malleable Founders Society, Cleveland...Dec. 2

Automotive Electric Association, 43rd Annual Meeting and 24th Annual Mfg.-Dist. Conference, Chicago .....Dec. 2-9

Industrial Building Exposition and Congress, New York.....Dec. 12-15

1961

SAE, International Congress and Exposition, Detroit .....Jan. 9-13

ISA, Winter Instrument-Automation Conference & Exhibit, St. Louis .....Jan. 17-19

1961 Plant Maintenance & Engineering Conference, Chicago Jan. 23-26

29th Annual Meeting, Institute of the Aeronautical Science, New York .....Jan. 23-25

12th Annual Plant Maintenance & Engineering Show, Chicago.Jan. 23-26

Society of Plastic Engineers, Inc., 17th Annual Technical Conference, Washington, D. C....Jan. 24-27

The Society of the Plastic Industries, Inc., 16th Reinforced Plastic Div. Conference, Chicago .....Feb. 7-9

American Foundrymen's Society, Wisconsin Regional Conference, Milwaukee .....Feb. 9-10

ASME, Gas Turbine Power Div., Co-Sponsored by The Dept. of Defense, 6th Annual Gas Turbine Conference & Show, Washington, D. C. .....Mar. 5-9

ISA, 11th Annual Conference on Instrumentation for the Iron and Steel Industry, Pittsburgh..Mar. 8-10

The Steel Founders' Society of America, Annual Meeting, Chicago .....Mar. 11-14

ASM, Western Metal Exposition, Los Angeles .....Mar. 20-24

Spring Technical Meeting, Pressed Metal Institute, New York.Mar. 22-24

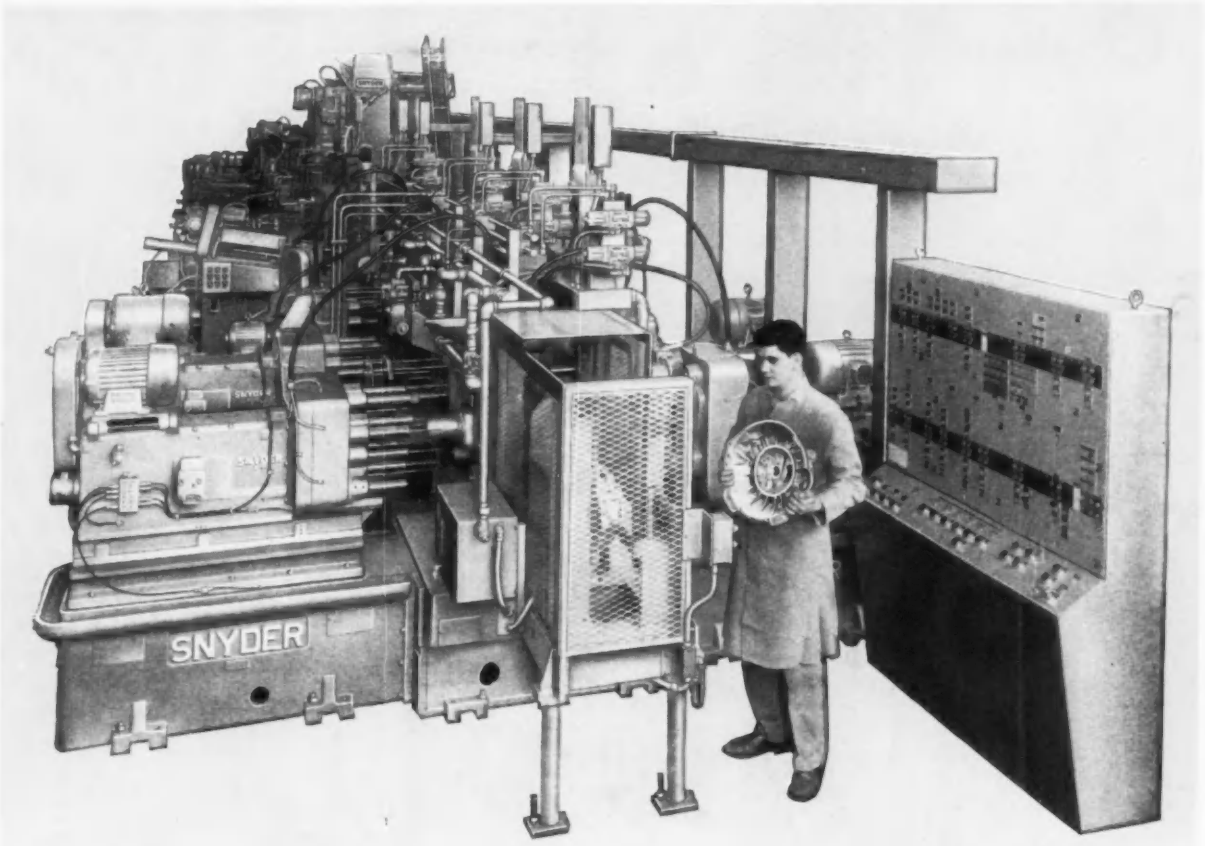
ASTME, 1961 Engineering Conference & Exhibit, New York..May 22-26

International Institute for Welding Meeting .....Apr. 10-15

American Welding Society, 42nd Annual Convention and Welding Exposition, New York .....Apr. 10-21

65th American Foundrymen's Society Exposition, San Francisco May 8-12

Circle 108 on Inquiry Card for more data



DIFFERENT SIZED PARTS INTERMIXED AT RANDOM ARE PROCESSED AUTOMATICALLY ON SNYDER SPECIAL 56-STATION TRANSFER

Here's another big Snyder special "building-block" transfer with a bit of extra versatility.

Specifications called for one sequence of operations on a big aluminum transmission cover case for domestic use and a different sequence on a smaller cover for export.

Schedules set a production rate of about four domestic units to one export unit but, for production convenience, the machine had to accept these parts intermixed at random and run them through automatically.

So, Snyder Engineering designed a "collar" which bolts to the smaller piece, bringing it up to locating and clamping dimensions of the larger piece. Lugs on the collar and workpiece control appropriate switches which by-pass certain operations. Parts are automatically positioned in process.

Operations include drilling, reaming, boring, tapping, chamfering, spotfacing, center holing, end milling, probing, air gaging, pressing in rectangular plug, pressing in bushing and a couple of washing operations.

Production is 150 parts an hour at 100% efficiency. Any of the 20 segments can easily be converted for comparable operations on other parts and the number of segments can be increased or reduced at any time. Your inquiries are invited.

SNYDER
CORPORATION
(Formerly Snyder Tool & Engineering Company)

3400 E. LAFAYETTE—DETROIT 7, MICHIGAN
Phone: LO 7-0123

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KEPS®

SAVE EXTRA MOTIONS... BY THE MILLIONS!

Eliminate an extra operation, repeated by the millions, by using KEPS, the quality fasteners with the *built-on* "lock washer." KEPS torsion-points grip firm, hold fast, for product dependability and customer satisfaction. A complete line of standard fasteners is available on fast delivery from National Lock ... also, special purpose fasteners engineered to your "specs." Write us.

KEPS, registered trademark of Illinois Tool Works

NATIONAL LOCK

FASTENER DIVISION • NATIONAL LOCK COMPANY • ROCKFORD, ILLINOIS

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We've
joined . . .

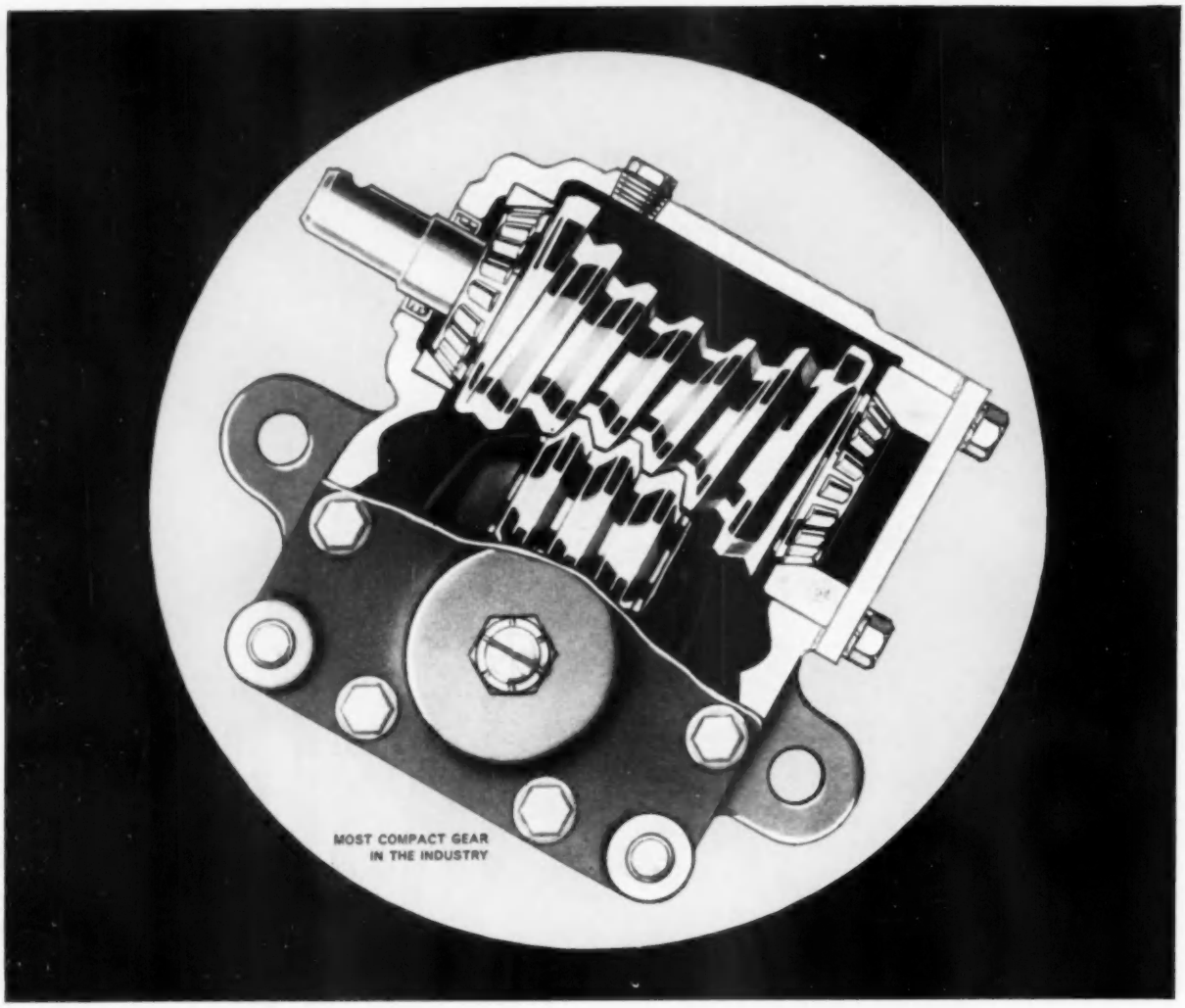
IMPERIAL EASTMAN



Happy occasion! The Imperial Brass Manufacturing Company of Chicago, producer of tube fittings and tools since 1905, and The Eastman Manufacturing Company of Manitowoc, Wisconsin, maker, since 1914, of rigid and flexible hydraulic power lines, have now joined hands. Happy occasion for us — happy occasion also, we trust, for our many mutual customers. Imperial-Eastman Corporation. General Offices: 6300 W. Howard St., Chicago 48, Ill.

IMPERIAL EASTMAN

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SMOOTHER STEERED WHEN GEMMER GEARED

Gemmer steering is engineered for strength and ease of operation . . . built for lifetime service and minimum maintenance. Customer pleasing features of the 7D gear are:

Compactness . . . High numerical ratio of 28:1 . . . An efficient, rugged gear . . . Simplicity of installation and adjustment . . . Available in either malleable or aluminum housings

For *your* steering needs, Gemmer offers you experience as old as the industry.

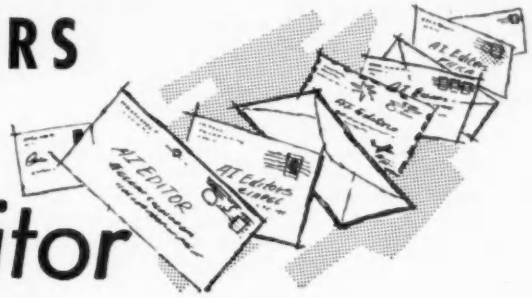
Gemmer steering
SINCE 1906

ROSS GEAR AND TOOL COMPANY, INC.

Gemmer Division, Detroit, Michigan • Ross Division, Lafayette, Indiana

Circle 112 on Inquiry Card for more data

LETTERS to the Editor



Readers' opinions or requests for additional information on material appearing in the editorial pages of AUTOMOTIVE INDUSTRIES are invited for this column. No unsigned letters will be considered, but names will be withheld on request. Address *Letters to the Editor*, AUTOMOTIVE INDUSTRIES, 56th & Chestnut Sts., Philadelphia 39, Pa.

PAGEANT OF CARS

A stunning, . . . or to use an AI word, . . . splendorous issue.

The best presentation, by far, of the new car line I've seen.

Chads O. Skinner
Public Relations
United States Steel
New York, N. Y.

"The pageant of 1961 cars" is the best layout on this subject I've seen.

Bob Dunne
Esso Research and Eng. Co.
New York, N. Y.

We are very much impressed with the new car insert in the October 15 issue of AUTOMOTIVE INDUSTRIES. The color seems unusually alive and made for a very impressive treatment. Would you be kind enough to give us a fill in on the production details, particularly, printing, paper, and details of the color work.

Our compliments on a very nice job.

Joseph H. Kuney
Asst. to the Director of Pubs.
ACS Applied Publications
Washington, D. C.

Congratulations on the first real forward step in the publishing of a trade magazine. Your 4 color editorial section is tops.

J. M. Gruitch
Director, Gov't Products
ACF Industries
New York, N. Y.

RELIABILITY

Your new publication on Reliability and Quality Control is certainly in tune with the times.

Most companies are very conscious of their responsibility to the customer to provide reliable and dependable products. In addition, we are conscious of the high cost of trying to rebuild or repair the product after it has once been placed in the customer's hands.

Mr. E. S. Wellock has been appointed Director of Chevrolet Reliability and is making great strides in this area to accomplish our quality objectives.

E. N. Cole
Office of General Manager
Chevrolet Motors Division
Detroit, Mich.

PRODUCTION

Your reprint "Making Production Pay" has certainly proved very popular. I have completely exhausted the supply that you sent me in filling requests from our members. If you have 25 extra copies floating around, I would certainly appreciate having them.

James C. Kelly
Executive Vice President
Machine Tool Distributors Assn.
Washington, D. C.

SILENCING

We have been very interested to see in your publication of August 15 an article describing the Silencing Techniques now used on the manufacture of the Rover motorcar, in which you have kindly made several mentions of our products and our name.

We should be very glad if you would kindly forward 6 copies of this issue and enclose the invoice for the cost of these articles.

F. S. Brough
Patents Dept.
Metalastik Ltd.
Leicester, Eng.



STANDARDIZE 100% ON SOUTHERN FASTENERS

Maintain maximum production speeds with dependable quality Southern fasteners, made in USA by a company that has specialized in standard fasteners for fifteen years.

Southern Screw's production facilities are geared to supply any quantity order from the broad line of standard fasteners that we make. Call your Southern Screw distributor, or write for current Stock List and details about Southern's free pallet system. Address Southern Screw Company, P. O. Box 1360, Statesville, North Carolina.

Manufacturing and Main Stock in Statesville, North Carolina

WAREHOUSES:
New York • Chicago • Dallas • Los Angeles

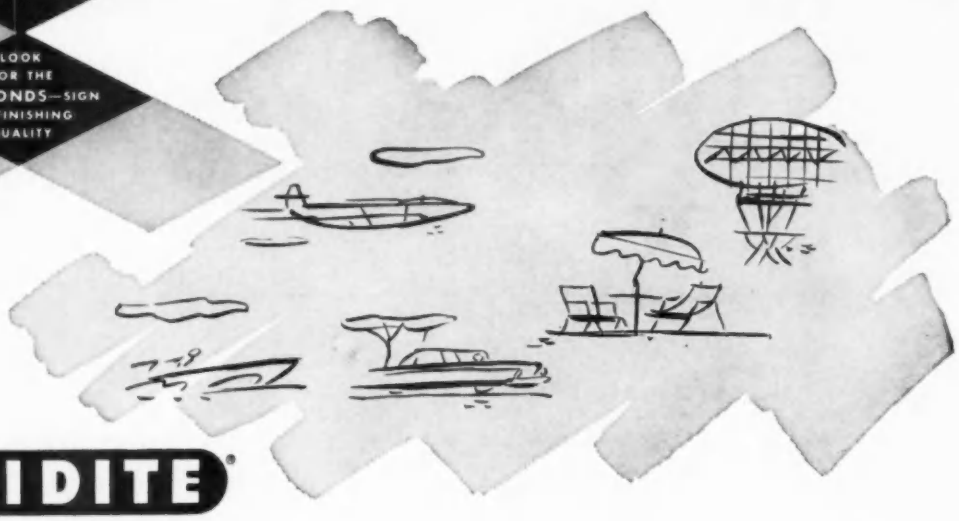
Machine Screws & Nuts • Tapping Screws • Stove Bolts • Drive Screws • Carriage Bolts • Continuous Threaded Studs • Wood Screws • Hanger Bolts • Dowel Screws

Head styles in: Slotted, Phillips; Flat, Round, Oval, Pan, Binding, Truss, Fillister, Washer, Hexagon, and Hex Washer.

Southern SCREW COMPANY STATESVILLE • NORTH CAROLINA

Circle 113 on Inquiry Card for more data

LOOK FOR THE DIAMONDS—SIGN OF FINISHING QUALITY



Only IRIDITE®

Process Engineered

Chromate Conversion Coatings

Give you 5 additional benefits for Corrosion Protection—Paint Base—Decorative Finishing

1 A COMPLETE PROCESS ENGINEERED LINE

Developed for specific applications, there is an Iridite to provide the finish you desire, fit the equipment you have available and give the performance you require. Most Iridite coatings meet rigid military and civilian specifications.

2 EXPERIENCED TECHNICAL SERVICE

Our large field engineering staff is thoroughly familiar with chromate conversion coatings and related finishing operations. They'll help you check every step in your finishing operation to make sure you're getting the best possible finish on your products.

3 PRODUCT AVAILABILITY

Warehouses located in strategic industrial areas enable us to provide you with fast, economical delivery on any Iridite.

4 ECONOMY

The superior performance of Iridite provides low final cost by extending operating life and lowering maintenance costs. In addition, Iridite gives you a finish that adds considerably to the value of your product. There's an Iridite to meet every cost and performance requirement.

5 RESEARCH AND DEVELOPMENT FACILITIES

If you have an unusual application, we will gladly work with you. Our entire staff of experienced engineers and chemists, and our completely equipped facilities are at your service.

IRIDITE—a specialized line of chromate conversion coatings for non-ferrous metals. Apply by dip, brush or spray methods — at room temperature — manually or with automatic equipment. Forms a thin film which becomes an integral part of the metal. Cannot chip, flake or peel. No special equipment, exhaust systems or specially trained personnel required.



If you are using chromate conversion coatings to finish zinc, cadmium, aluminum, magnesium, silver, copper, brass or bronze — consider the above benefits of Iridite. For complete information, contact your Allied Field Engineer. He's listed under "Plating Supplies" in the yellow pages. Or, write for FREE TECHNICAL DATA FILE.

Allied Research Products, Inc.

4004-06 EAST MONUMENT STREET • BALTIMORE 5, MARYLAND
BRANCH PLANT: 400 MIDLAND AVENUE • DETROIT 3, MICHIGAN
West Coast Licensee for Process Chemicals: L. H. Butcher Co. • European Agent: Sture Gronberger, Storgatan 10, Stockholm, Sweden

Chemical and Electrochemical Processes, Anodes, Rectifiers, Equipment and Supplies for Metal Finishing

IRIDITE® Chromates | IRILAC® Coatings | ISOBRITE® Brighteners | ARP® Supplies | WAGNER Equipment

Circle 114 on Inquiry Card for more data



Mr. S. E. Miller, Vice President and Division Manager of American Bosch Arma, shows the hundreds of items which go into the manufacture of a fuel injection pump (upper left of table).

IBM MOS

MANAGEMENT OPERATING SYSTEM SAVES AMERICAN BOSCH $120,000 YEARLY ON SHOP ORDERS ALONE

...TRIPLED SAVINGS ANTICIPATED WHEN SYSTEM IS EXPANDED!

American Bosch has turned to IBM's new systems techniques for faster, more sensitive control of its manufacturing cycle at the Springfield, Massachusetts, plant. Utilizing the IBM Ramac 305, the Management Operating System has been applied to Materials Planning and Inventory Management, and large savings have already accrued.

These additional savings are expected from methods now in use:

■ sharp reduction of machine setup costs. ■ standardized production levels, to minimize manpower fluctuations and concentrate inventory dollars on active sales items. ■ substantial time reduction in production schedule changes. ■ automation of annual standard cost revisions, with a 70% expense cut.

When the Management Operation System is extended to other areas, American Bosch estimates that savings will be tripled.

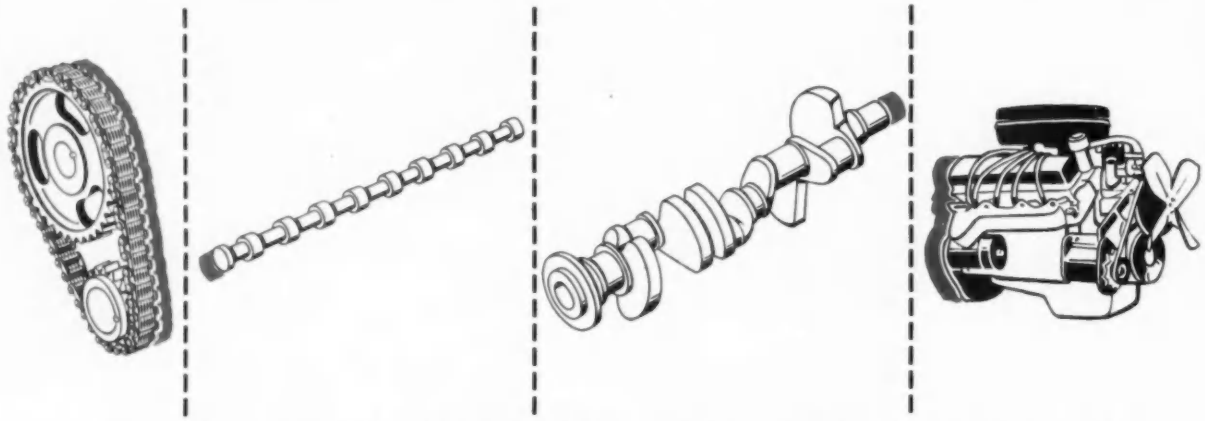
MOS can be applied to most industrial operations, with specially trained manufacturing representatives to assist you. IBM Balanced Data Processing provides comprehensive support in applying the system to your company's operation. For full information, call your nearest IBM office.

BALANCED DATA PROCESSING ▲ **IBM**®

Circle 115 on Inquiry Card for more data

Link-Belt's narrow timing chain started...

a cost-shaking "chain reaction"



Narrow chain and sprockets = Shorter camshaft + Shorter crankshaft + Shorter engine length

narrow timing chain puts savings in the millions

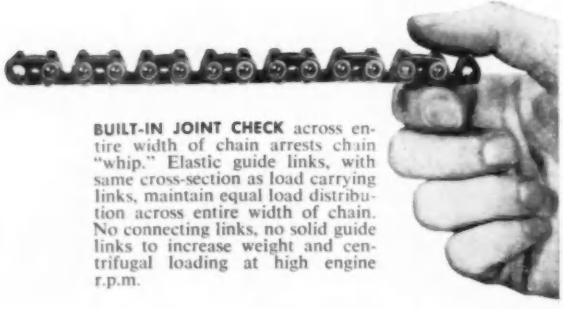
Automobile engine designs that begin with Link-Belt's *narrow* timing chain lead to appreciable savings: shorter camshaft, shorter crankshaft, narrower face sprockets, shorter overall engine length. Total savings? Millions of dollars for the manufacturers who use it!

This durable chain closely maintains factory-set timing during thousands of miles of car operation. Segmental bushings automatically provide snug joints, reduce "slap," resulting in longer and quieter chain life.

Ask us about how this chain has accommodated a more-than-100% increase in engine horsepower. Let us show you why Link-Belt timing chains are standard with three of the four major automotive manufacturers. Write for Book 2065 for complete specification data. 15,382



LONG-LIFE DESIGN with round pins free to rotate—not tied together with extra links—distributes wear evenly over entire surface of pins. Segmental bowed bushings maintain snug joints, assure thousands of miles of quiet, accurate timing.



BUILT-IN JOINT CHECK across entire width of chain arrests chain "whip." Elastic guide links, with same cross-section as load carrying links, maintain equal load distribution across entire width of chain. No connecting links, no solid guide links to increase weight and centrifugal loading at high engine r.p.m.

LINK-BELT

TIMING CHAINS AND SPROCKETS

LINK-BELT COMPANY: 220 S. Belmont Ave., Indianapolis 6, Ind.

Circle 116 on Inquiry Card for more data

THE NEW GIANT FOR INDUSTRY...
THAT STANDS WAIST HIGH TO A GROWING BOY!



NEW BLOOD BROTHERS "150 WB" UNIVERSAL JOINT

HAS AN ULTIMATE YIELD OF 600,000 INCH POUNDS OF TORQUE... WITH A SWING DIAMETER OF ONLY 13½ INCHES!

The boy in the picture is holding one of Blood Brothers' smaller universal joints to show the relative size of its giant new "150WB." One of the largest universal joints ever built commercially, it will adequately handle 162,000 inch pounds of torque using a safety factor of 10 to 1 . . . in a swing diameter of only 13½ inches! The "150WB" was designed for compact installation in such operations as rolling mills, gantry cranes and ship drive shaft applications. In spite of its size, this giant unit may be assembled or disassembled by removing 4 bolts.

The "150WB" proves again that you can get the exact universal joint you need from one source . . . anything you need from a simple assembly built to handle 350 inch pounds of torque, to the "giant" in the industry. Whatever your requirements, either a standard item, or an unusual design for a special application, Rockwell-Standard engineers can meet your specifications . . . at a considerable saving in cost. Write or call for complete details today!

Another Product of...

ROCKWELL-STANDARD
CORPORATION
Universal Joint Division, Allegan, Michigan

Circle 145 on Inquiry Card for more data

BUILD IN STRENGTH AND LIGHT WEIGHT WITH N-A-X FINEGRAIN STEEL



In a wide variety of applications N-A-X FINEGRAIN—a low-alloy high-strength steel—can bring important weight savings without sacrifice of strength and safety. When you design N-A-X FINEGRAIN into your product, you get *all* these advantages:

- It is 50% stronger than mild carbon steel.
- Polishes to a high luster at minimum cost.
- Can be cold formed readily into difficult stampings without surface disturbances.
- Is stable against aging.
- Has high fatigue life with great toughness.
- Has greater resistance to wear and abrasion.
- Is readily welded by any process.
- Offers greater paint adhesion.
- Has twice the resistance of carbon structural steel to normal atmospheric corrosion.*

*Where greater resistance to extreme atmospheric corrosion is important, our N-A-X HIGH-TENSILE is recommended.

Sound like something for you? A thoroughly competent metallurgical service organization is available to work with you on any application problem you may have. Write, wire or phone Product Development Department, Great Lakes Steel Corporation, Detroit 29, Michigan.

N-A-X FINEGRAIN STEEL

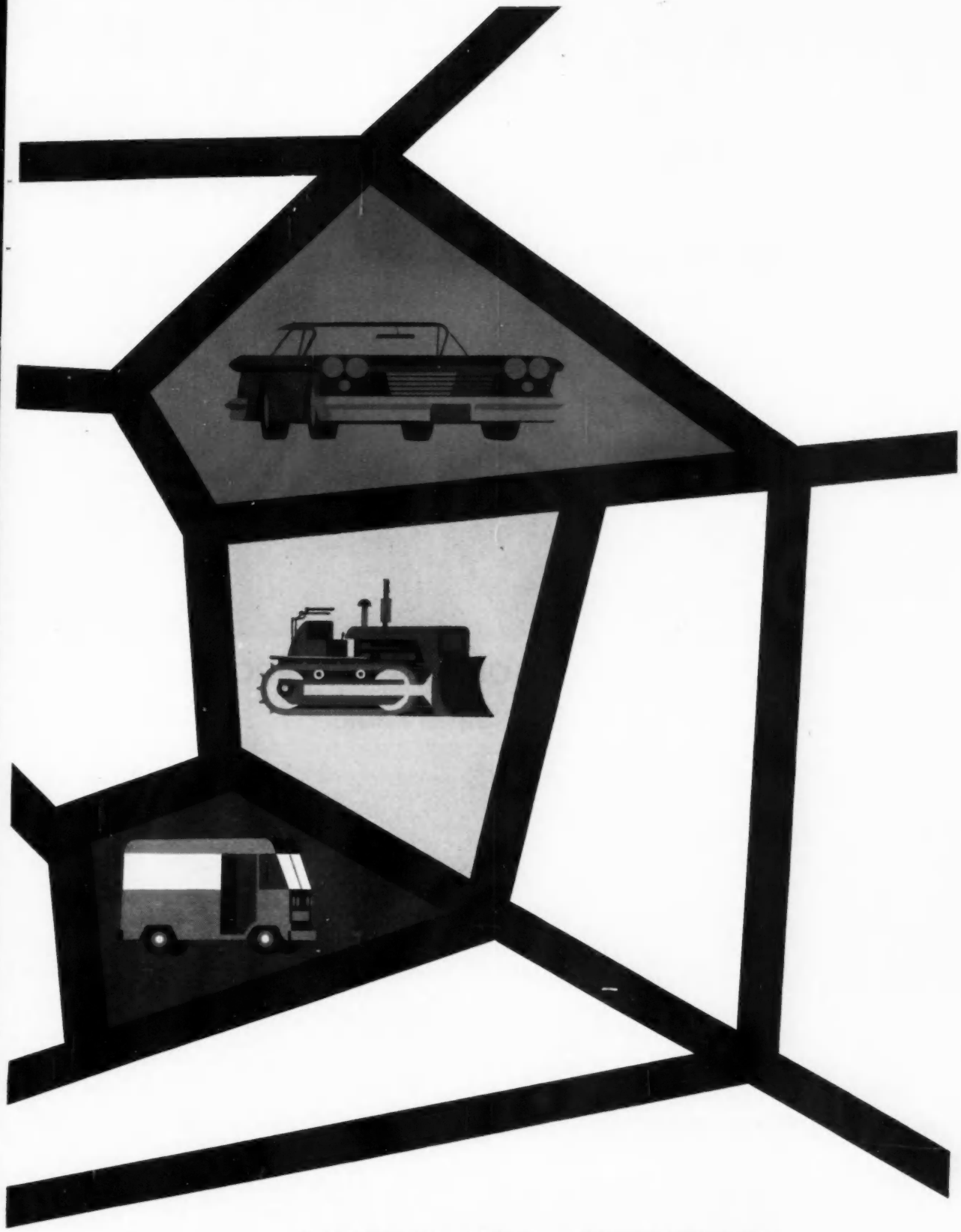
A PRODUCT OF

GREAT LAKES STEEL

Detroit 29, Michigan

Steel

Look for the STEELMARK on the products you buy; place it on the products you sell.



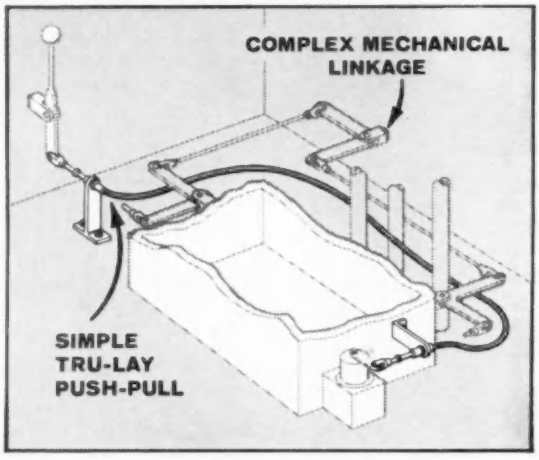
Great Lakes Steel is a Division of **NATIONAL STEEL CORPORATION**

Circle 118 on Inquiry Card for more data

ACCURATE REMOTE CONTROL FOR HUNDREDS OF PRODUCTS

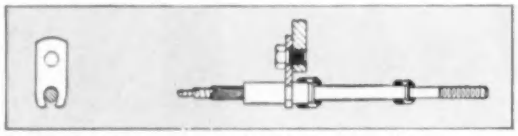
— — with Tru-Lay *PUSH*-PULL Controls

If your products involve remote control—electrical, hydraulic, pneumatic or direct—TRU-LAY PUSH-PULL FLEXIBLE CONTROLS can help solve your design problems. They provide positive remote control over short or long distances—up to 150 feet from the control point. Because they operate while flexing, they can snake around obstructions. They will not buckle. They are ruggedly constructed, easily installed and operated, sealed against dirt and moisture, and will handle jobs with as much as 1,000 lbs. input. PUSH-PULL CONTROLS are simple, have but one moving part, are noiseless and give a lifetime of accuracy. Mechanical linkages, on the other hand, are complex. Unlike PUSH-PULL CONTROLS, they are made of many parts, wear at many points, and produce increased backlash, vibration rattles and lost accuracy.

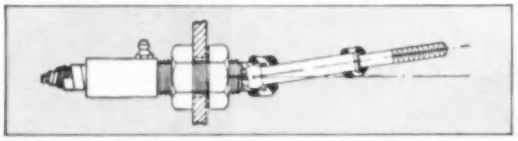


THESE FEATURES HELP SOLVE DESIGN PROBLEMS

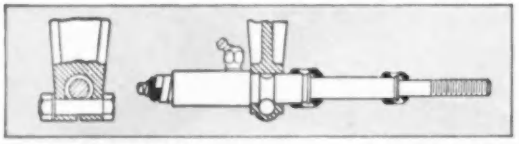
Anchorages



Clip anchorage • a simple clip for light loads

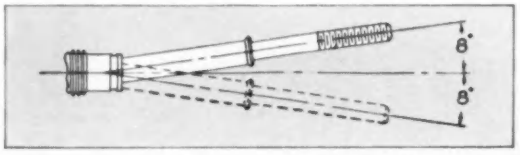


Bulkhead anchorage • for heavy-duty installations



Machined bracket anchorage • can be furnished for mounting any PUSH-PULL cable at the swivel terminal

Swivel Action



Standard assemblies have end fittings with a swivel movement of ± 8° to compensate for misalignment and rise or fall of lever arms. Swivel joints, and the sliding ends, are sealed against dirt and moisture.

PUSH-PULL DATA FILE SHOWS HOW TO SIMPLIFY, IMPROVE DESIGN



• Write for your PUSH-PULL Data File. It contains a complete set of engineering bulletins which describe in detail the operation of PUSH-PULL CONTROLS, their applications, features and advantages.

ACCO

PUSH-PULL CONTROLS

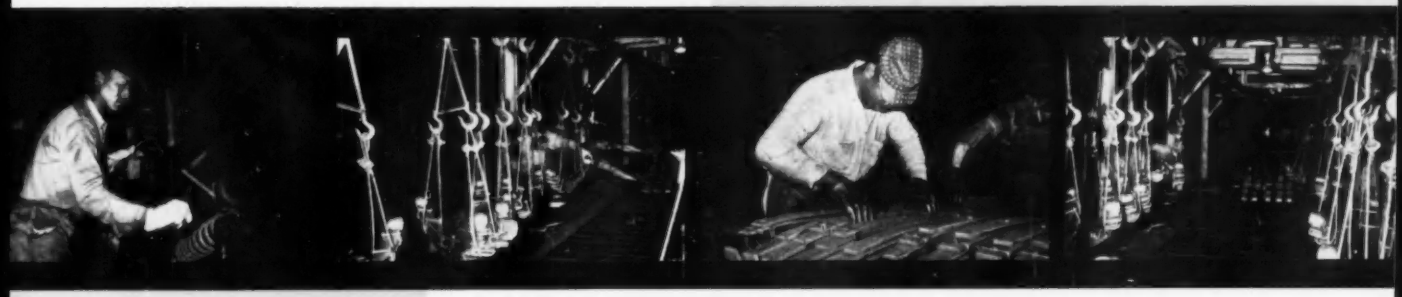
Automotive and Aircraft Division • American Chain & Cable Company, Inc.

601-H Stephenson Bldg., Detroit 2

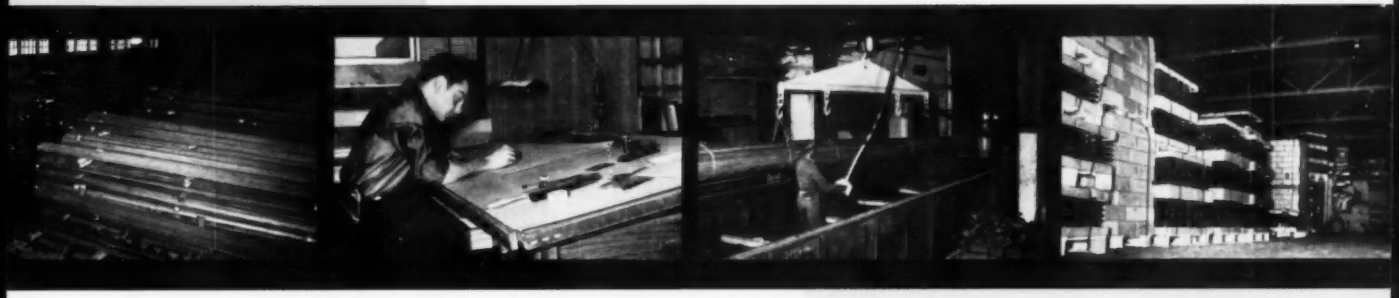
6800-H East Acco Street, Los Angeles 22 • 929-H Connecticut Ave., Bridgeport 2, Conn.

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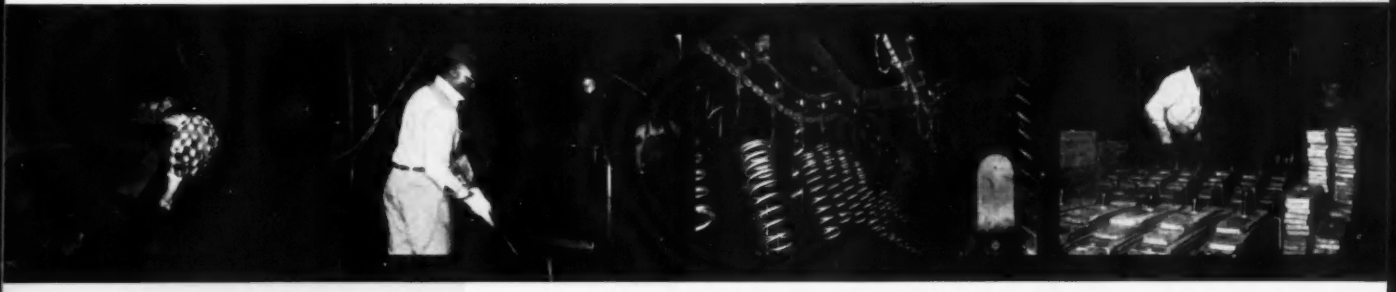
This is **BURTON**



since 1923, a top quality manufacturer



of springs for trucks, trailers, cars

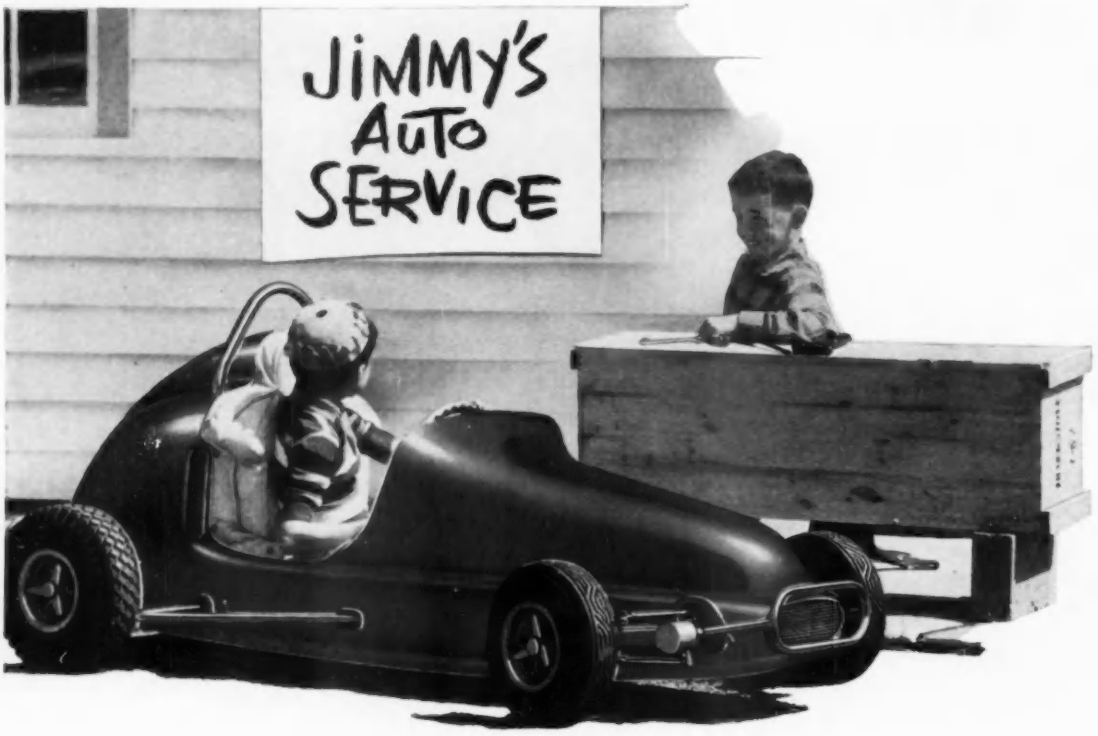


Millions of springs a year
. . . let us quote on yours!

BURTON **AUTO SPRING CORPORATION**

48TH STREET AT WESTERN AVENUE • CHICAGO 32, ILLINOIS

Circle 120 on Inquiry Card for more data



"How's she running, Bobby?"

Bobby's slick, little racer is probably running "fine", for it has a relatively simple engine with a minimum number of parts to worry about. Modern production-built automobiles are, of course, more complicated. For example, take the carburetor—heart of an automobile engine. It's a complex mechanism with as many as 90 to 125 separate parts and assemblies.

And—each model carburetor must be designed, engineered and built to the exact requirements of the car and its engine if smooth, efficient performance and maximum economy are to be assured.

Holley has been supplying precision-built carburetors to major manufacturers of automobiles for over 55 years. Through continuing research, Holley has contributed numerous improvements and new developments to carburetion and ignition to keep pace with the changing demands of cars and their engines.

In 1960, Holley Carburetors are *original equipment* on ten popular makes of cars—including four of the seven compacts built in the United States.



Holley Carburetors and Ignition Equipment maintain the Holley reputation for precision quality and dependable performance.

HOLLEY Carburetor Co.

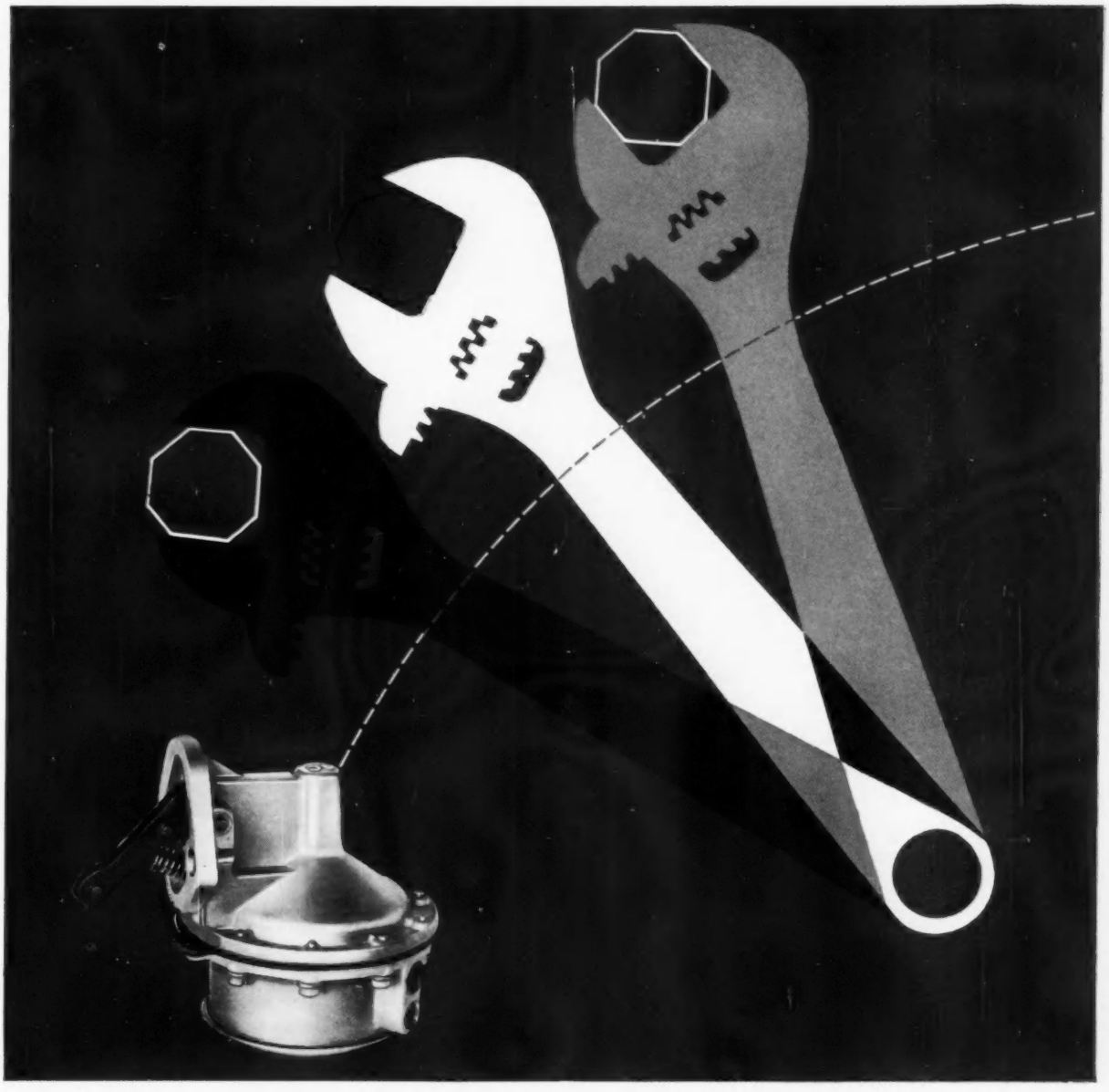
Researchers and Developers in THREE of America's Most Important Industries

11955 E. Nine Mile Road • Warren, Michigan I-33

AUTOMOTIVE DIVISION • AIRCRAFT DIVISION • ELECTRO-MECHANICAL DIVISION

Circle 121 on Inquiry Card for more data

YOU CAN'T BEAT AC FOR PRODUCT KNOWLEDGE



These facts can add new leverage to your Fuel Pump requirements

Over 31 years of fuel pump know-how are yours at AC—to help make your job easier. Consider these facts: AC fuel pumps are used as original equipment by 138 engine builders . . . AC has produced over 1000 different fuel pumps . . . AC has 22 highly trained engineers and technicians working on fuel pumps exclusively . . . AC fuel pump engineers spend over 1000 hours annually working with customers in their own plants . . . AC fuel pumps are tested on a fleet of over 450 cars . . . AC has a staff of skilled technicians working on prototype fuel pumps and customer samples. Call the nearest AC office below. You'll get fast ACtion at AC!

AC

RELIABLE PRODUCTS HELP YOU SELL

AC SPARK PLUG THE ELECTRONICS DIVISION OF GENERAL MOTORS

FLINT—1300 No. Dort Hwy. CEdar 4-5611 | CHICAGO—7074 N. Western Ave. ROgers Park 4-9700 | DETROIT—General Motors Bldg. TRinity 5-9197 | LOS ANGELES—7000 Telegraph Rd. RAymond 3-5171

To learn how an Aardvark licks termites...
call in a *ZOOLOGIST*

(specialist on animals)



A native of Africa, the AARDVARK is a large, nocturnal, burrowing mammal subsisting largely on termites and has a long extensile tongue for gathering them. He has heavy claws for ripping open rotten logs to find more termites.

To learn how to lick welding problems... call in *LINCOLN*

(specialists in arc welding)

A VIRGINIA manufacturer of underground gasoline storage tanks needed to cut his welding costs . . . his highly competitive industry being plagued with low profits.

Although they were already using the LINCOLN automatic submerged arc process, the LINCOLN Field Engineer was able to show this company how to eliminate 25% of their welding labor. He switched them to the new LINCOLN vapor shielded INNERSHIELD process.

Now the 4000-gallon tanks, fabricated from 3/16" steel, are welded at 90 inches per minute . . . with three men doing the job formerly done by four. Thus, reduced labor costs have substantially increased the profit margin.

In addition, when this manufacturer licks a rolling and fit-up bottleneck, the three weldors will be able to almost double their present output with no additional help.

That's why we say it's a good idea to do business with LINCOLN where arc welding is a specialty and cost reduction comes to you as a "plus" at no charge.

THE LINCOLN ELECTRIC COMPANY
Dept. 1750 • Cleveland 17, Ohio

LINCOLN WELDERS

Circle 122 on Inquiry Card for more data

Corvair by Chevrolet

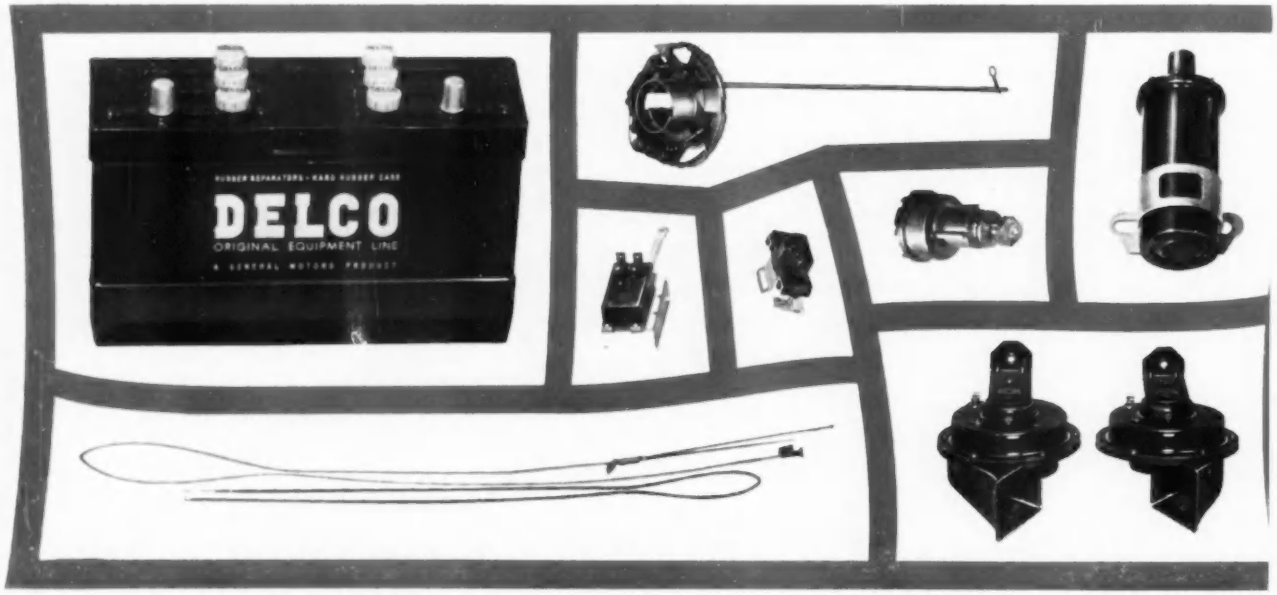


Tempest by Pontiac



...electrical systems

Delco-Remy systems provide electrical energy for the needs of motion in General Motors new size cars, too. Special electrical systems were developed by Delco-Remy working closely with Chevrolet, Pontiac, Buick and Oldsmobile. In all four new cars, these lighter units deliver the same kind of reliable high performance that has been built into Delco-Remy electrical systems for over fifty years.



Special
by
Buick



F-85
by
Oldsmobile



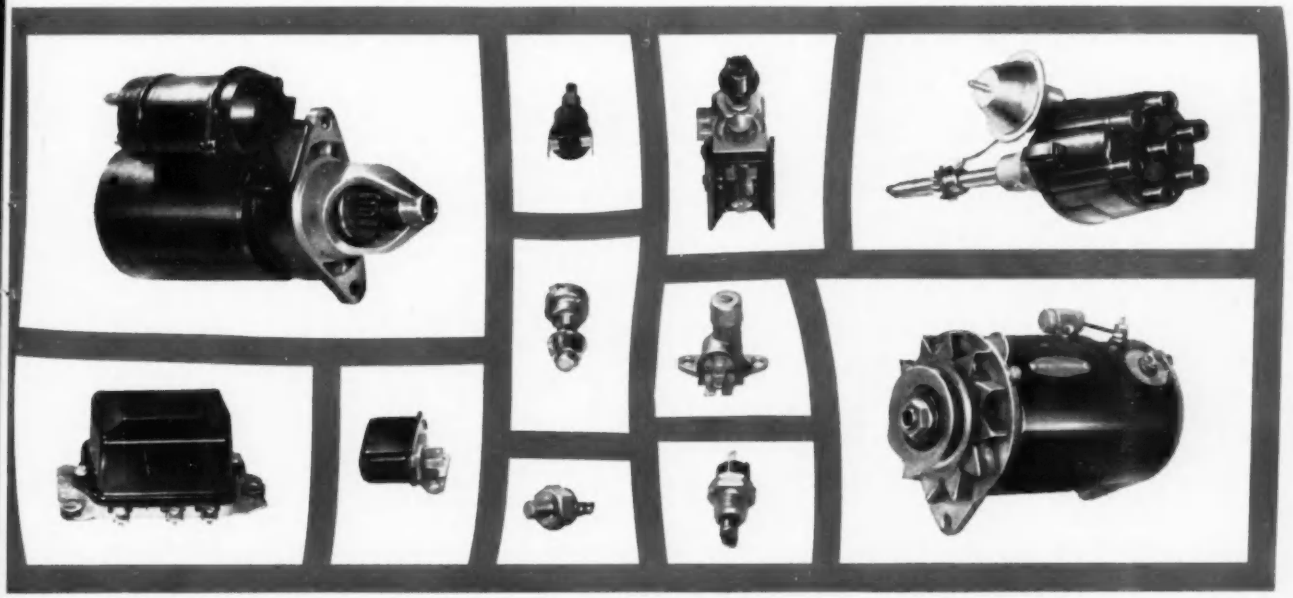
by Delco-Remy

Delco-Remy equipment for the Corvair, Tempest, Special and F-85 includes • Generators • Regulators • Cranking Motors • Distributors • Ignition Coils • Horns • Flexible Cable Controls • Directional Signal and Control Switches • and Delco Batteries.

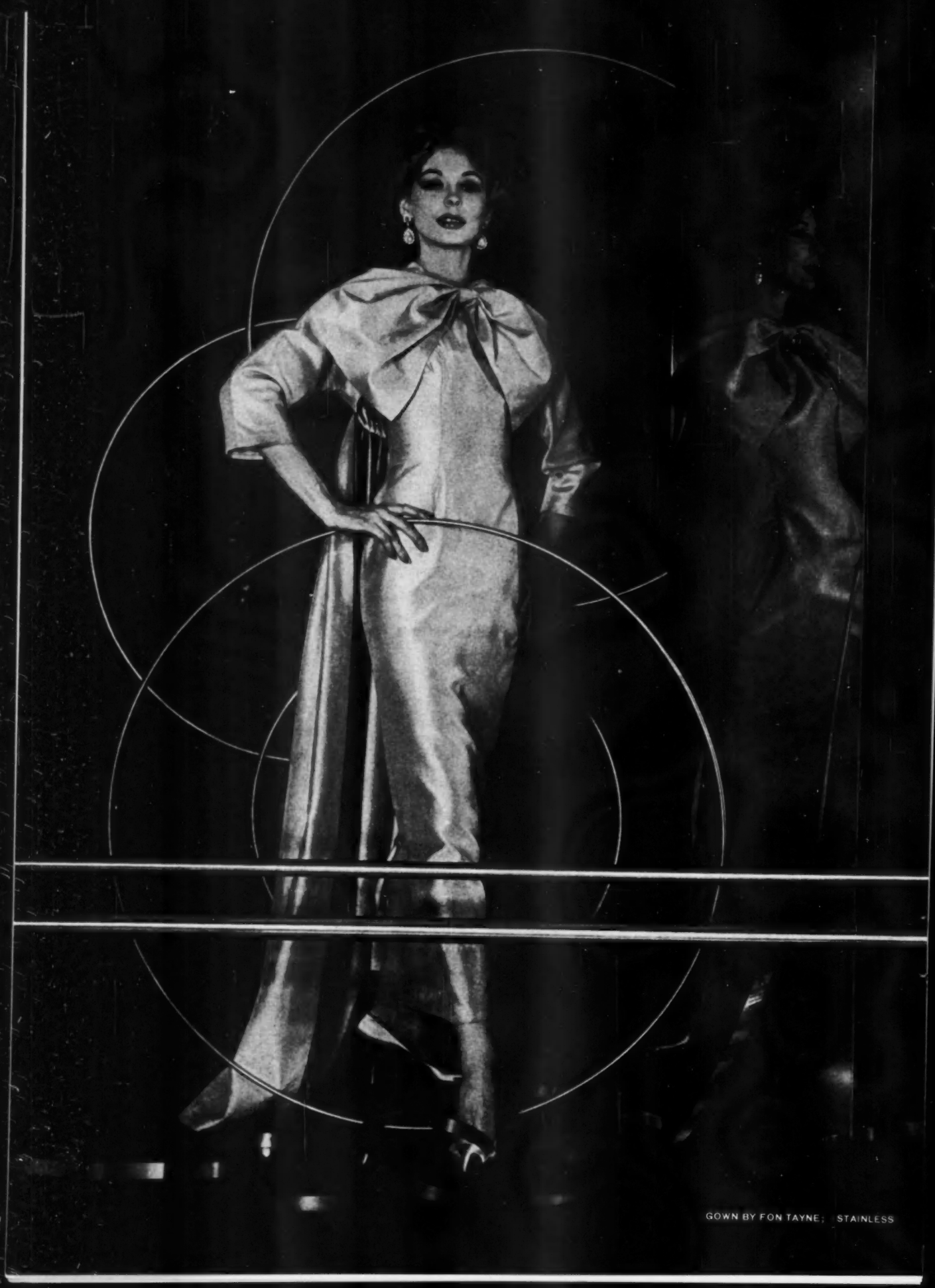
Delco-Remy electrical systems

From the highway to the stars

DIVISION OF GENERAL MOTORS, ANDERSON, INDIANA



Circle 123 on Inquiry Card for more data



GOWN BY FON TAYNE; STAINLESS



stainless from creative Crucible

Crucible Stainless reflects beauty

Crucible stainless steel possesses its own beauty — a finish that is truly lustrous and gleaming. This finish is produced on the most modern mill equipment, by Crucible craftsmen, to exact processing specifications.

Add the beauty of Crucible stainless to your products — to reflect your products' quality. For samples of this remarkably fine finish — and engineering services that match it — call or write the nearest of Crucible's 35 local steel service centers.

CRUCIBLE

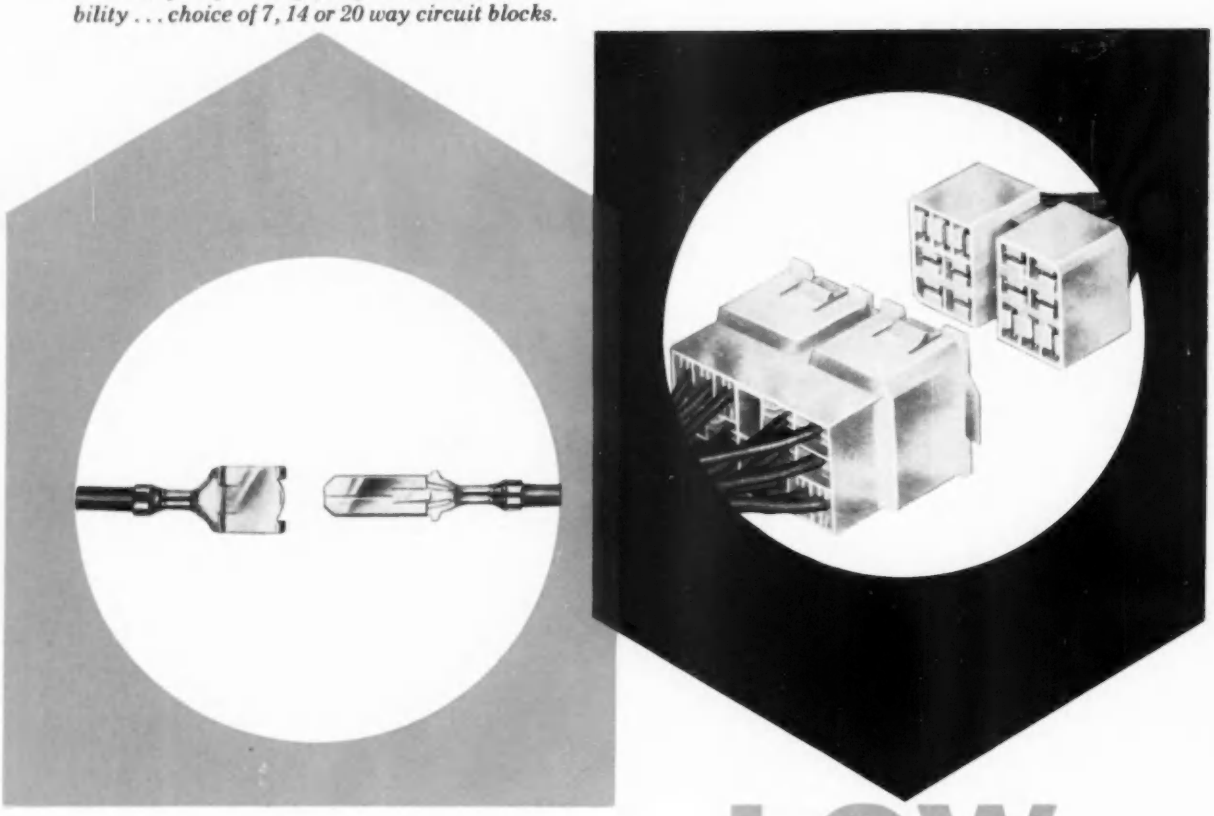
Stainless Steel

SHEET, STRIP, BAR AND WIRE BY CRUCIBLE STEEL COMPANY OF AMERICA, PITTSBURGH 30, PA.

Circle 124 on Inquiry Card for more data

HIGH

20-25 amperage rating for greater design flexibility . . . choice of 7, 14 or 20 way circuit blocks.



LOW

2-5 pounds insertion and extraction force for easier installation and servicing.

NEW AMPEEZ CONNECTOR GIVES YOU BOTH

Here is a workhorse of a connector! Housed in tough nylon and designed to carry as many as 20-circuits while holding insertion-extraction forces to 2-5 pounds, AMPEEZ Connectors are adaptable to many applications calling for a heavy-duty, easily serviced multiple-circuit disconnect.

AMPEEZ Connectors will match your application needs perfectly . . . anything you call for up to 20-circuits and 25 amps. One other major feature! *AMP's exclusive Tab-Gap Lok assures a constant contact pressure even under the severest vibration conditions.*

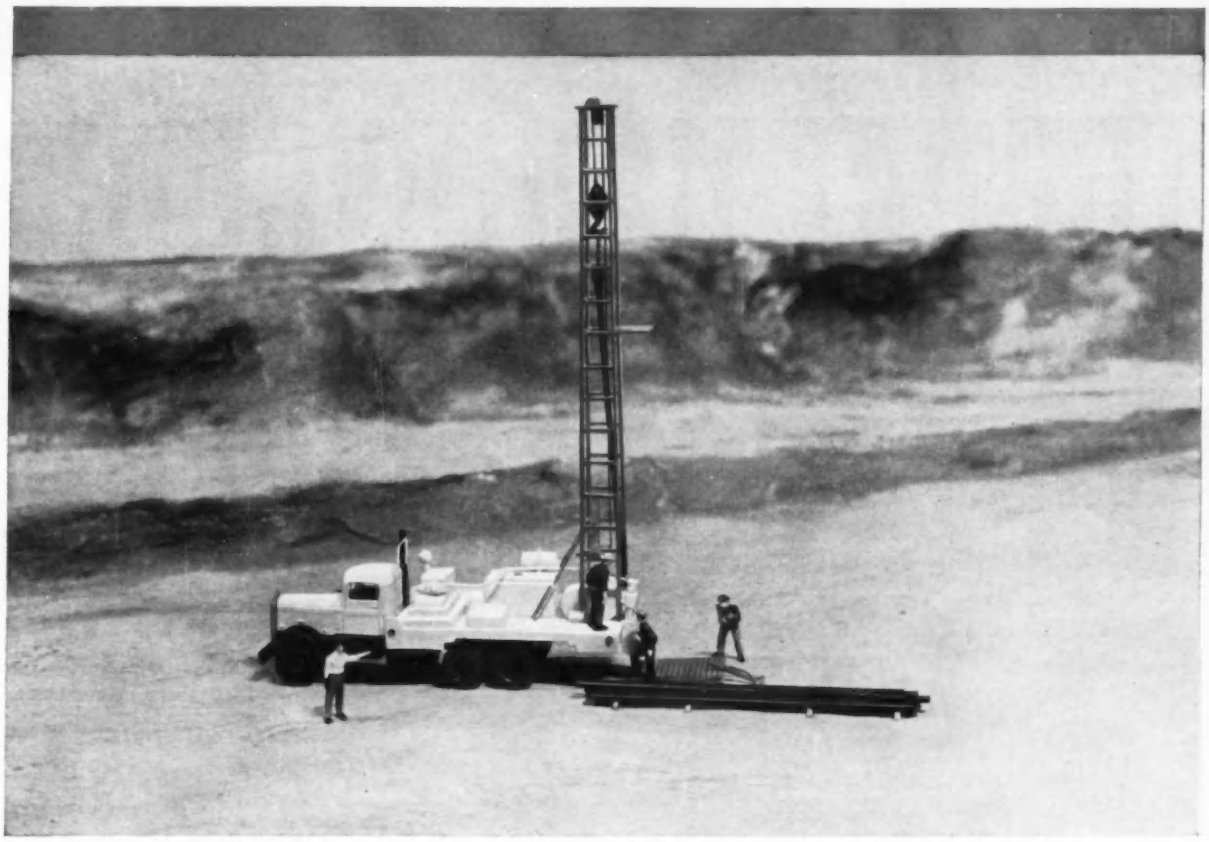
Use AMPEEZ Connectors, eliminate the human error in individual connections . . . make them fast and safe. Send today for AMPEEZ Connector literature and sample of tab and receptacle with Tab-Gap Lok.

AMP INCORPORATED

GENERAL OFFICES: HARRISBURG, PENNSYLVANIA

AMP products and engineering assistance are available through subsidiary companies in: Australia • Canada • England • France • Holland • Italy • Japan • West Germany

Circle 125 on Inquiry Card for more data



Down-to-earth reasons for using Custom Quality OHIO Tubing

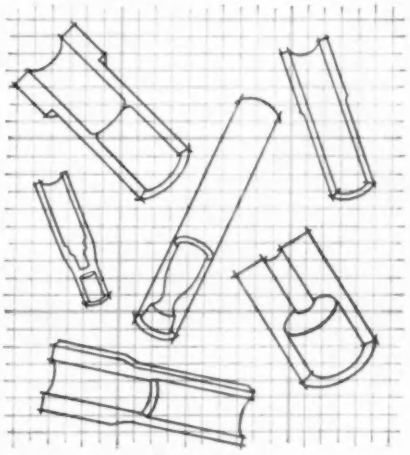
As in rotary drilling, which uses steel tubing internally upset by Ohio Seamless, greater strength and lighter weight may be important in your product.

So before selecting a tubing source consider these important facts. OHIO Tubing is always the exact tubing you need for your product because OHIO Tubing is CUSTOM MADE for your product. Your order is manufactured to your own specifications to produce steel tubing especially for your application — the precise grade, analysis, size, shape, special anneal and tolerances best suited to your needs.

Ohio Seamless Tube produces both seamless and electric welded steel tubing — is prepared to form many finished or semi-finished tubular parts to your designs.

To get the most from your next steel tubing order, use Custom Made OHIO Tubing. Contact your nearest Ohio Seamless representative, or send part drawings to the plant at Shelby, Ohio — Birthplace of the Seamless Steel Tube Industry in America. A-3061A

Model illustrated built to 3.5 mm scale.



Typical Ohio Seamless tubular upset forgings

OHIO

OHIO SEAMLESS TUBE

Division of Copperweld Steel Company • **SHELBY, OHIO**

Seamless and Electric Resistance Welded Steel Tubing • Fabricating and Forging

SALES OFFICES: Birmingham, Charlotte, Chicago (Oak Park), Cleveland, Dayton, Denver, Detroit (Huntington Woods), Houston, Kansas City, Los Angeles (Lynwood), Miami, Moline, New York, New Orleans (Chalmette), Philadelphia (Wynnewood), Pittsburgh, Richmond, Rochester, St. Louis, St. Paul, Salt Lake City, Seattle, Tulsa, Wichita

CANADA: Railway & Power Engr. Corp., Ltd. • EXPORT: Copperweld Steel International Company, 225 Broadway, New York 7, New York

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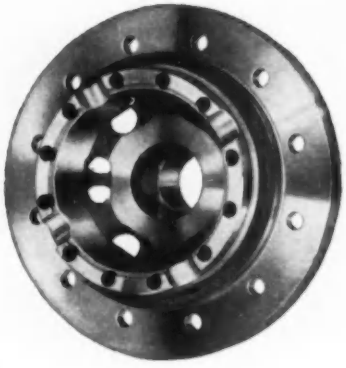
if your twin problems are

product improvement

and # cost reduction

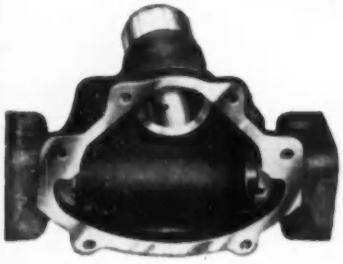
NATIONAL HTM CASTINGS

are the answer











HTM is strength . . . toughness . . . wear and fatigue resistance . . . non-seizing. HTM is higher machinability than B1112 steel . . . it's closer as-cast tolerances that can reduce or wipe out machining operations.

If you're reappraising your product from a competitive point of view . . . if you're looking for production economies—look into HTM castings. Yes, HTM is many things—and it's just made to order for many mass-produced products just like yours.

A-1151A



NATIONAL MALLEABLE and STEEL **CASTINGS COMPANY**

Established 1868 *Cleveland 6, Ohio*

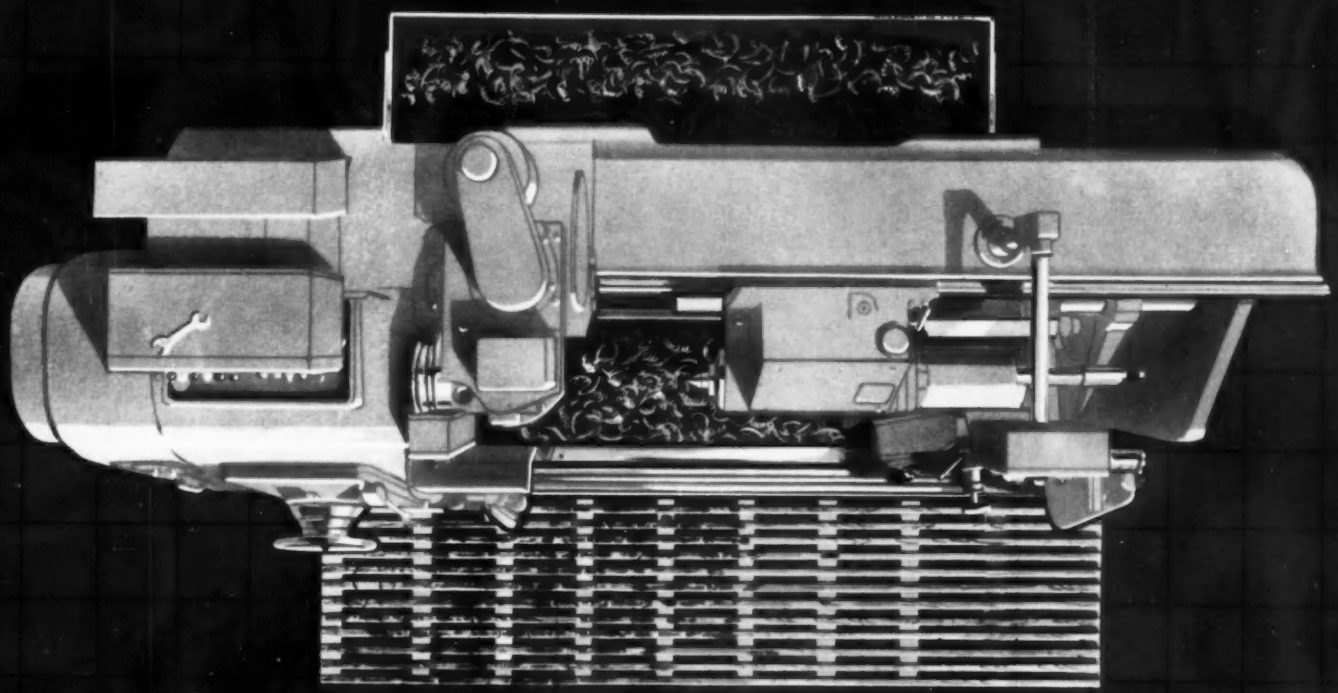
HTM (Pearlitic Malleable) is many things—and they all add up to a *better product at lower finished cost.*

MEMBER MALLEABLE CASTINGS COUNCIL

The nation's largest independent producer of malleable and pearlitic malleable

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You can turn a profit on a New Britain +GF+ Copying Lathe

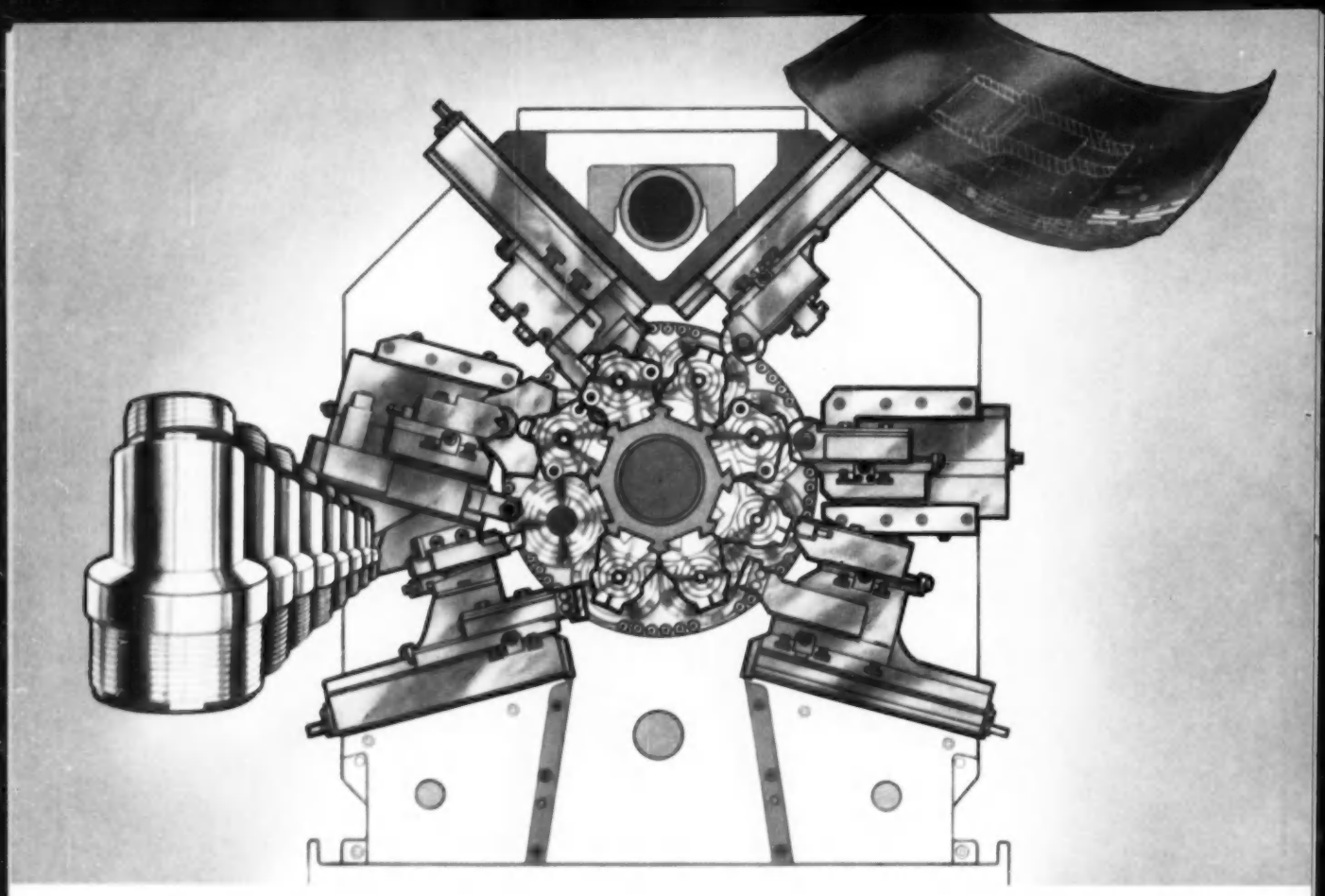
Here's a birdseye view of a New Britain **+GF+** Copying Lathe. It shows some important differences between this machine and conventional lathes with copying attachments. The point here is this—*the most effective use of the single-tool copy-turning principle can be made only with a machine designed from the ground up for this type of work.* The New Britain **+GF+** is just such a machine. Notice the chip pan. It's big (it has to be) and located for easy removal of chips from the back of the machine. The design of the work area allows for unobstructed free-fall of chips out of the way and into the pan.

The New Britain **+GF+** is massive and rugged, with plenty of power—up to 40 h.p., if you need it. It's simple to operate, quick to set up and change over. The single-point tool can be changed in one minute and it out-produces gang tooling setups in the bargain. Turning is controlled by either a template or a prototype. External and internal copying are accomplished in one set-up with special tooling.

The possibilities for short or long run chucked and between centers work on the **+GF+** are wide and varied. Because the work is produced with good surface finish and dimensional accuracy, grinding can be reduced and, in some instances, eliminated. Large diameters are broken down economically by successive parallel cuts, automatically if desired, with optional two-cut or multi-cut recycling.

You've got to see one of these machines in action to fully understand the kind and quantity of work they are capable of producing. Contact your New Britain Representative for demonstration arrangements or write The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.

THE NEW BRITAIN MACHINE COMPANY
New Britain-Gridley Machine Division - New Britain, Connecticut



Unlimited tooling combinations with New Britain Bar Machines

Nothing can out-date your operation quicker than better machines in the hands of a competitor. In the race to keep ahead on quality, price and delivery, nothing can put you out front faster than machines capable of consistently producing the highest quantity of finished pieces at the lowest possible cost. New Britain's new series of bar machines represents in every way the most advanced bar-turning units available. Each of the four-, six- and eight-spindle models has been redesigned, adding new features and improving older ones. Unlimited cross slide and end-working tool combinations, extremely fast operation (even on stainless) and a variety of models and features to choose from add up to some good reasons for incorporating New Britains into your replacement or production expansion plans.

The eight-spindle model is the largest, most modern eight-spindle bar machine available. It has a stock capacity of up to $2\frac{5}{8}''$ and provides six independently-operated cross slides. As with all New Britain bar machines, the operations of the cross slides and end-working tool slide are disc-cam controlled for positive actuation, close tolerance machining and easy, rapid change-overs.

This is only a very small part of a story that is bound to interest you. The whole story and its significance in terms of your profits is available from your New Britain Representative. If you prefer, contact us directly at The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.

THE NEW BRITAIN MACHINE COMPANY
New Britain-Gridley Machine Division - New Britain, Connecticut

NEWS

Vol. 123, No. 10

Nov. 15, 1960

Tiny S-P Compact Next?

4-Cylinder, Water-Cooled Engine Likely

By Hugh C. Quinn, Detroit Regional Editor, and C. B. Campbell, News Editor

Studebaker-Packard Corp., reportedly is planning a new, smaller compact for the 1962 model year. The four-passenger car, with a wheelbase of less than 100 in., would be powered by a four-cylinder water-cooled engine of about 130 cu in.

The new compact may be what S-P is looking for to bolster sales. After a good initial year with the Lark, Studebaker sales suffered during 1960 with the rash of competitive compacts. With the size and price area immediately above Lark well covered by Lancer, Comet, F-85, Ambassador, Tempest and Buick Special, the best step would seem to be to move in the other direction.

Studebaker-Packard, of course, is not alone in considering this market for a smaller compact. All five of the American automobile companies are known to be investigating this area, and at least one other—Ford Motor Co.—is pushing plans to bring out a four-passenger vehicle.

According to one report circulating in Detroit, Studebaker-Packard already has committed tooling money for its little car.

With the compact field already crowded, Chrysler is said to be planning smaller Plymouth and Darts for '62. This, it appears, will mean even more competition in the compact and medium size fields.

FOUR-CYLINDER SKODA FELICIA CONVERTIBLE



Czech engine develops 54 hp at 5700 rpm with top speed of 87 mph. A detachable laminated fiberglass top is available to replace orthodox canvas.

McNamara Heads Ford

Robert S. McNamara, 44, one of the "whiz kids" brought into the firm shortly after World War II, was named president of Ford Motor Co. on Nov. 9.

Henry Ford II, 43, continues as board chairman and chief executive officer. He will be responsible for general management with emphasis on policy and planning. Mr. McNamara's responsibilities will be concerned with operations.

In other changes, James O. Wright, 48, succeeds Mr. McNamara as vice president and group executive-car and truck divisions. He was vice president and general manager of the Ford Div.

Lee A. Iacocca, 36, former vehicle marketing manager, Ford Div., becomes a Ford vice president and general manager of the Ford Div. succeeding Mr. Wright.

Charles R. Beacham, 60, vice president and former assistant general manager, Ford Div., was appointed to a new staff position, vice president-marketing.

Mr. McNamara joined Ford in 1946 as manager of planning office and financial analysis office. In 1949 he was promoted to controller and in 1953 was appointed assistant general manager, Ford Div. He was named a vice president and general manager, Ford Div., in 1955. In May, 1957, he was named vice president and group executive-car and truck divisions. In August of that year he was named a director of Ford Motor Co.

October Sales Good

The automotive industry sold 540,000 cars last month, with Chrysler, American Motors and Ford all registering increases over last year.

Chrysler sales of 78,781 were 20 per cent higher than September and 21 per cent higher than last October. For the first 10 months of the year, retail sales of 799,452 units were 36 per cent higher than a year ago. In September, Chrysler passed its 12-month total for 1959.

American Motors sales in October totaled 36,616, the highest in history for that month and 13 per cent over last October's deliveries. The total also showed a 37 per cent gain over September. Ten-month sales of 366,803 Ramblers were 19 per cent over record 1959.

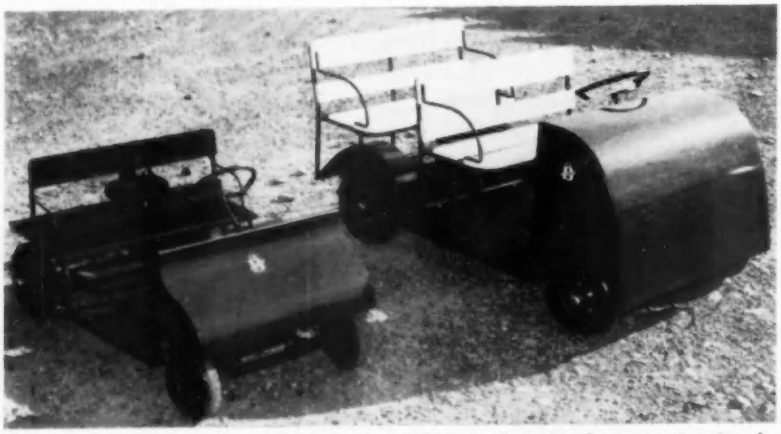
From Ford Motor Co. comes reports of the best October since 1955. Sales totaled 166,909 units, including 134,106 Fords, Falcons and Thunderbirds. Falcon deliveries alone totaled 41,036, and Comet sales amounted to 20,760, a record.

GM sales of 251,000 units ran about 9000 behind last year, with Pontiac and Chevrolet dropping, Buick and Oldsmobile holding their own, and Cadillac setting an October record with 150,004 units sold. The Cadillac figure topped last year by 600 units and was the second best month in the car's 59-year history.

Olds and Buick, although the year-ago figures, were slightly higher, nevertheless had their best month of the year. Chevy sold a total of 131,000 cars in October, including about 19,000 Corvairs. A year ago the division sold 133,531 cars, including 23,750 Corvairs. So Corvair sales were off, but big car sales climbed slightly.

Studebaker sales dropped sharply in October, from 12,150 a year ago to 6577. S-P is looking for a boost later in the year when its new six-cylinder engine takes hold.

BANTAMS FOR INTRA-PLANT TRAVEL



These bantam cars can attain speeds of 16 to 18 mph. Larger one also is available with truck body. It is powered with one or two Briggs & Stratton three hp engines and has load capacity of 600 lb. Smaller model has 300 lb capacity. Built with Ryerson steel by B & B Specialty Co., Cincinnati.

Industrial Designers Elect Officers

The Industrial Designers Institute has elected the following officers and members of the Executive Committee at the trustees' meeting:

John Vassos, Norwalk, Conn., board chairman; Leon Gordon Miller, Cleveland, president; Joseph M. Parriott, New York, executive vice president; Henry P. Glass, Chicago, Midwest vice president; Donald W. Brundage, San Francisco, West Coast vice president; Miss Ann Frank, New York, secretary, and Carl G. Bjorncrantz, Chicago, treasurer.

Chevrolet Expansion

Chevrolet has announced two plant expansion programs, one in Muncie, Ind., the other in Tonawanda, N. Y. The Muncie expansion, slated to begin Dec. 1, will add 71,214 sq ft of manufacturing space and 5580 sq ft of material receiving area. The additions will bring total manufacturing floor space to 524,000 sq ft.

In Tonawanda, the division has taken over a 750,000 sq ft plant formerly owned by the government, and used for aviation engine manufacturing. Chevrolet operated the plant during World War II and the Korean War, building 65,400 aviation engines for the armed forces.

The Muncie expansion will give Chevy more "elbow room" for the production of manual transmissions, torsion bars, Corvair axles and other car and truck parts. The Tonawanda plant will be integrated with Chevy's existing plant, forge and foundry nearby.

Hertz Plans to Buy 26,100 Cars, Trucks

The Hertz Corp. has announced plans to buy 26,100 new model cars and trucks for $88 million. The record figure compares with $81.1 million spent last year for 23,800 new vehicles.

Walter L. Jacobs, president, said the purchases would include 14,400 cars for $45.4 million for Rent A Car service; 8000 cars for $22 million for long-term fleet leasing, and 3700 trucks for $20.7 million for the truck leasing division.

Compact cars will comprise 15 per cent of the 1961 fleet, Mr. Jacobs said, Most of the cars will be deluxe four-door sedans or hardtops equipped with automatic transmission and power steering.

2 Awards Presented

Theodore W. Selby, senior research chemist for General Motors Research Laboratories Fuels and Lubricants Dept. has been awarded both the Russell S. Springer and Henry Ford Memorial awards from the Society of Automotive Engineers.

Presented by the national SAE, the Springer award goes to the youngest author of a technical paper of permanent interest to be published by the SAE. The Henry Ford award, presented by the Detroit SAE section, goes to the junior member who writes the best technical paper on ground vehicles.

This is the first time the two awards, for which only SAE members under 33 can compete, has been presented to the same man. Both awards were made for the same technical paper authored by Mr. Selby, "Automatic Transmission Fluid Viscosity at Low Temperatures and Its Effect on Transmission Performance."

Widow Heads Firm

Mrs. Mary Adelaide Ferguson, widow of Harry Ferguson, the British tractor manufacturer, has succeeded her husband as chairman of his company, it has been announced in London.

Mr. Ferguson obtained a settlement of $9.2 million from the Ford Motor Co. and associates over patent infringement claims eight years ago.

His company, Harry Ferguson Holdings, Ltd., has a factory in Detroit and operates in India, France, Australia and South Africa.

Fewer 8-Cylinder Cars

Less than half the cars sold in the United States in July were equipped with eight-cylinder engines. This was the first time in seven years that eights were a minority.

Auto registrations for July showed only 49 per cent of cars with eight cylinders.

July was the first month since October, 1953, that eight-cylinder autos were below 50 per cent of total registrations. The high month was January, 1957, when 82.8 per cent of all registrations had the larger engines.

During the first eight months of this year, eights accounted for 52 per cent; sixes for 40 per cent and fours for eight per cent. There were 4,483,194 registrations.

ONE OF WORLD'S LARGEST DUMP TRUCKS



LeTourneau-Westinghouse Co.'s Model 60 Haulpak weighs only 33 tons, yet it can haul payload almost twice its weight. It is powered by 550 hp Cummins V-12 turbocharged Diesel and six-speed Allison Torqmatic transmission.

NEWS

CONTINUED

ARMY ORDNANCE UNIT OPENS NEW MEETING SERIES



Conversing at opening of new series of meetings of New York Post, Army Ordnance Association, are (from left) William L. Donovan, vice president, Celanese Corp. of America; Jerry M. Gruitch, director of government products, ACF Industries; Assistant Secretary of the Army George H. Roderick, the main speaker, and Hartley W. Barclay, editor and publisher of AUTOMOTIVE INDUSTRIES.



Chairman Barclay introduces Assistant Secretary of the Army George H. Roderick.

Gen. Hiester Shifted

Brig. Gen. David W. Hiester, Director of Field Services, Ordnance Tank-Automotive Command, Detroit, has been assigned to 8th Army duty in Korea. He begins his new duties in January.

Lightweight Armor

Significant progress in the modernization program to provide its fighting men with lighter, more efficient weapons and mobility has been made, the Army reported recently.

In addition to lighter and more efficient rifles and mortars, development of a new self-propelled 105 mm. howitzer, an eight-in. howitzer, a 155 mm. howitzer and a 175 mm. rifle will reflect a weight reduction of seven tons for the 105 to 21 tons for the eight in. howitzer. Use of aluminum and more economical Diesel type engine have helped reduce weight.

The Army is developing a new helicopter, the Chinook, which, in addition to other missions, will provide battlefield mobility for the Pershing weapons system.

In the hunt for lighter and more effective aircraft, the Army has emphasized turbine engines. Some already are in use, others are in various stages of testing. Use of new, lighter metals in engines and airframes gives an aircraft, particularly the helicopter, a greater load capacity, thus increasing the ground force mobility.

Army Panel Grows

Five new members have been named to the Army Scientific Advisory Panel to bring the group to 60 members.

Among the new panelists are: John G. Holstrom, vice president, Kenworth Motor Truck Div., Pacific Car and Foundry Co.; James C. Zeder, former vice president, Chrysler Corp., and Dr. Hector R. Skifter, president, Airborne Instruments Laboratory, Division of Cutler-Hammer, Inc.

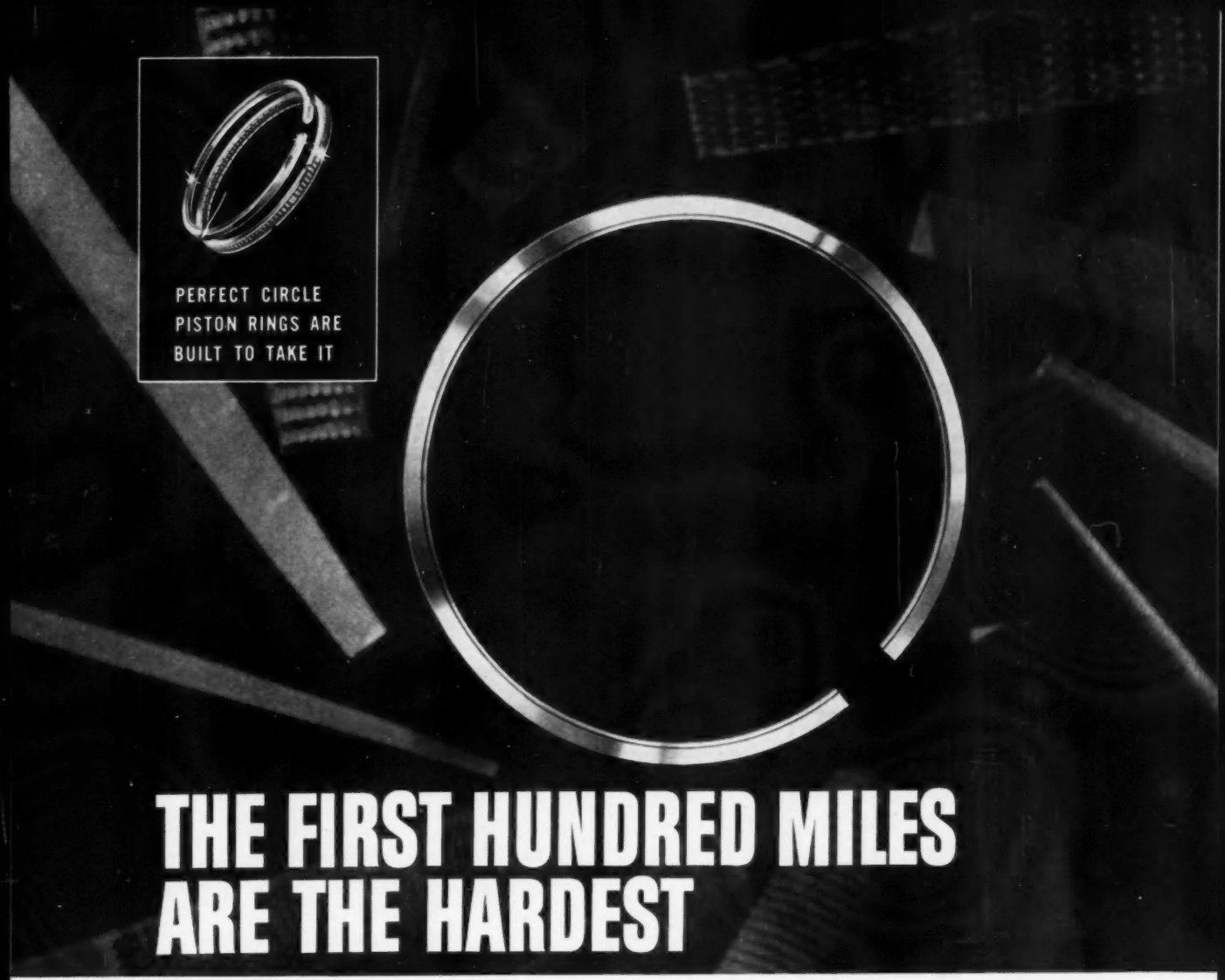
Army Honors Keller

K. T. Keller, former Chrysler Corp. president, has been awarded the Distinguished Civilian Service Medal for outstanding service on the Army Scientific Advisory Panel. The award was made by Secretary of the Army Wilber M. Brucker.

The Army advisory panel, composed of 60 of the Nation's leading civilian scientists, engineers, industrialists and educators was established in 1951. It assists the Secretary of the Army and the Chief of Staff in their joint responsibility to give the United States a ground fighting force as effective, economical and progressive as resources will permit.

Army Orders 'Copters

Fourteen Bell Helicopter Corp.'s new HU-1A turbine-powered helicopter trainers have been ordered by the Army. HU-1A is a modification of Bell's HU-1 Iroquois helicopter. It is used to train helicopter pilots to fly by instruments for all-weather operations.



THE FIRST HUNDRED MILES ARE THE HARDEST

In any new or rebuilt engine there are many areas where moving metal surfaces must adjust to each other. Of all these areas one of the most important is the bearing surface between piston rings and cylinder wall. To assure rapid mating, and protect against "borderline lubrication," Perfect Circle compression rings are either chrome plated or coated with Ferrox.

Where Ferrox is required the coating acts as a polishing agent—much like jeweler's rouge—smoothing away surface irregularities, and protecting against scuffing. Only Perfect Circle offers genuine Ferrox protection.



No matter how hard the miles, from first to last, Perfect Circle rings are built to take it. Use Perfect Circles every time—preferred for performance.

PERFECT CIRCLE

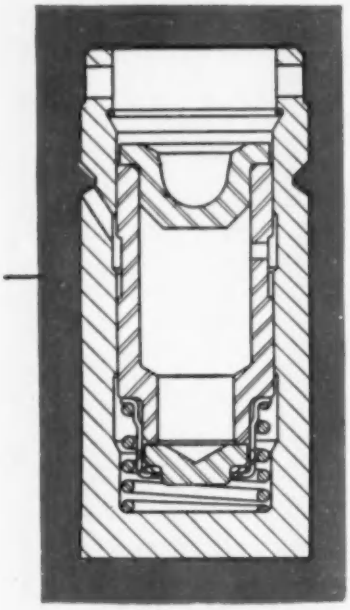
PISTON RINGS · PRECISION CASTINGS · POWER SERVICE PRODUCTS · SPEEDOSTAT

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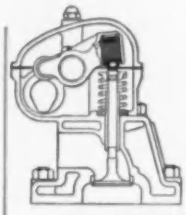
HAGERSTOWN, INDIANA · DON MILLS, ONTARIO, CANADA

Designing valve gears?

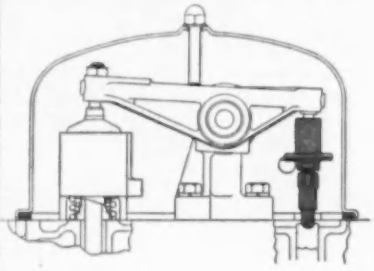
We invite you to use these specialized CHICAGO services



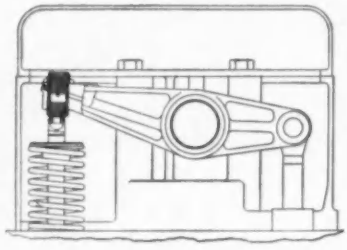
CHICAGO SPRING-LOADED FLAT VALVE HYDRAULIC TAPPET



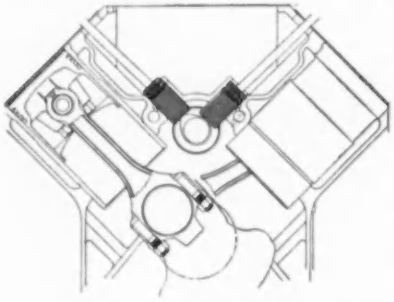
INSERT TYPE ROCKER ARM UNIT



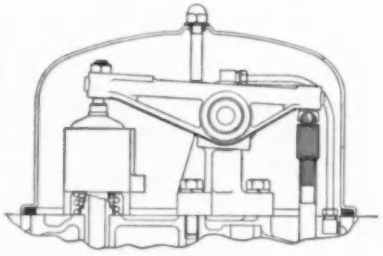
PUSH ROD TYPE FOR COMPRESSION RELEASE APPLICATION



THREADED TYPE ROCKER ARM UNIT



V-8 AUTOMOTIVE HYDRAULIC TAPPET APPLICATION



HYDRAULIC UNIT ON END OF PUSH ROD

Design

of complete valve gear installations for any type of engine . . . passenger car, truck, tractor, diesel, aircraft or industrial.

Development engineering

based on years of specialized experience in valve gear problems. The skills of our engineers will prove a valuable addition to your own engineering staff.

Tappet manufacturing

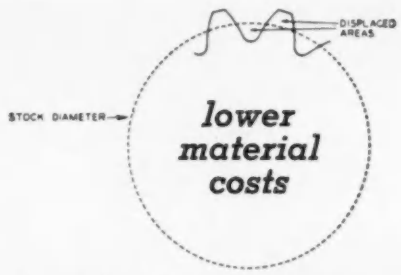
CHICAGO's facilities insure precision-manufacturing, scientific testing and rugged, trouble-free performance in every tappet. We welcome the opportunity to serve you.

THE CHICAGO SCREW COMPANY

ESTABLISHED 1872 • DIVISION OF STANDARD SCREW COMPANY

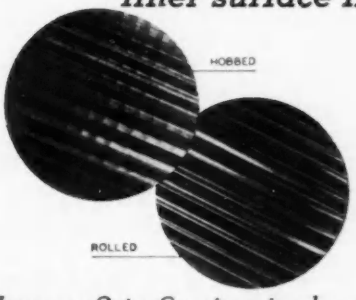
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smaller diameter shafts can be used...

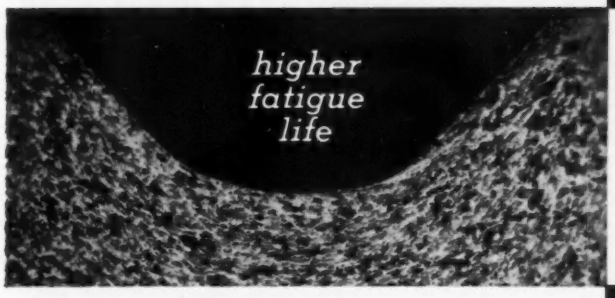
finer surface finish



as low as 3 to 6 microinches...

YOU GET ALL THESE

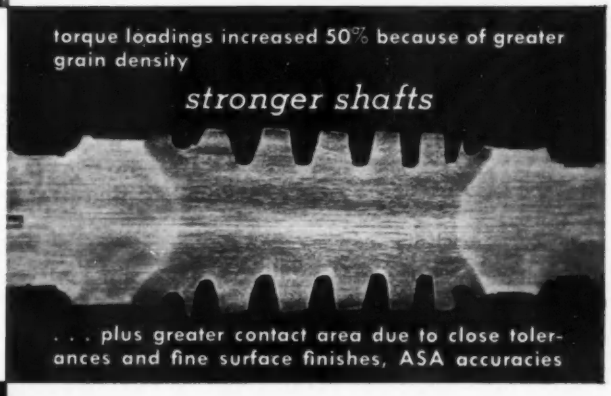
when you design for chipless machining...

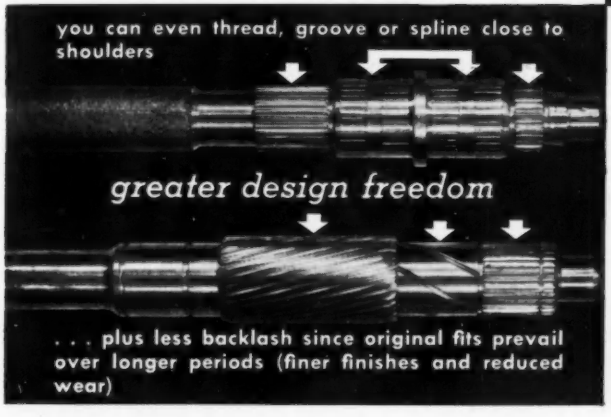


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for helical splines
straight splines • tapered splines
positive index splines • oil grooves
worm threads • threaded shafts
either singly or in combination

Roto-Flo processing also gives your shop increased output—up to 30 times per machine; ability to produce different parts on same machines; combining of operations on same machine; far lower tool cost per piece; better quality control; and total elimination of costly 'chip production'.





Ask for Bulletin RF-60MD on "Roto-Flo Chipless Machining"...

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High Tensile Iron Pistons

Increase the dependability of your engines with G&E High Tensile Iron Pistons. Each one is designed, cast, and machined to your specifications, to give you uniform operating characteristics.

Why not take advantage of more than 90 years of casting and piston machining experience at G&E. Complete facilities from lab to label assure efficient, economical production.

Write for complete information—include your specifications.

G&E HAS COMPLETE CASTING FACILITIES

We cast any product high-tensile iron, aluminum alloy, bi-metals. Tell us what you want.



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841 DOUGHTY STREET, LAKE CITY, MINNESOTA

Casting and Piston Specialists • Established 1868

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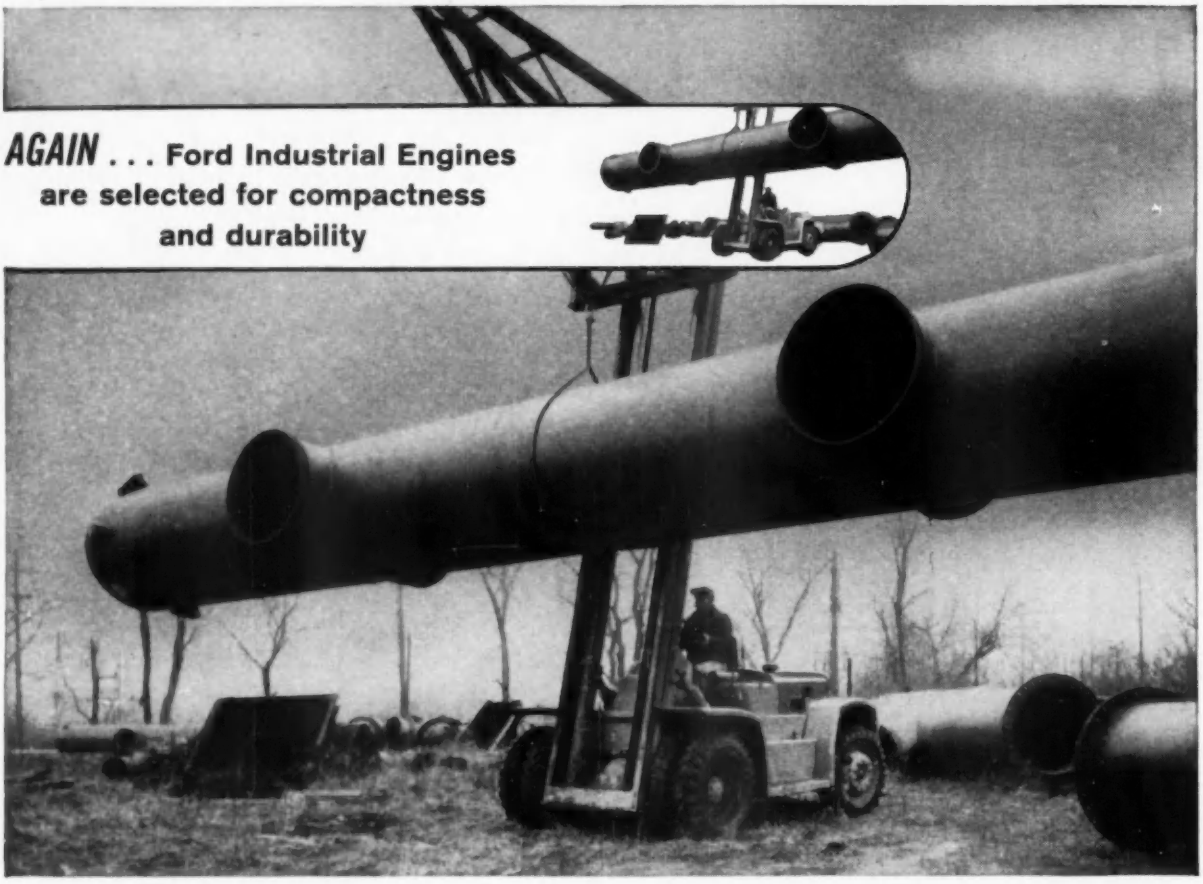


Stainless steel reduces weight! An exceptionally high strength-weight ratio makes stainless steel an ideal material for thousands of applications. Designers can count on this property with the assurance that there will be no loss of design properties — ever. For stainless resists corrosion, dents, scratches, and heat. Its beauty is *solid* and is as permanent as anything you can name. No wonder designers say "Yes" to stainless. And the best stainless steels of all are made with Vancoram Products! Vanadium Corporation of America, 420 Lexington Avenue, New York 17, N. Y. • Chicago • Cleveland • Detroit • Pittsburgh

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RUGGED FORD 272 V-8 ENGINE PROVIDES THE "BIG LIFT" FOR ANOTHER LEADING OEM

Meet the Yale G-3 Lift Truck—a "sure-footed" work horse that can tote 20,000-pound loads over rough terrain with unbelievable speed and ease. Just as Ford power contributes to the effectiveness of the Yale G-3, a Ford Industrial Engine can help bring new efficiency to your equipment. Here's why:

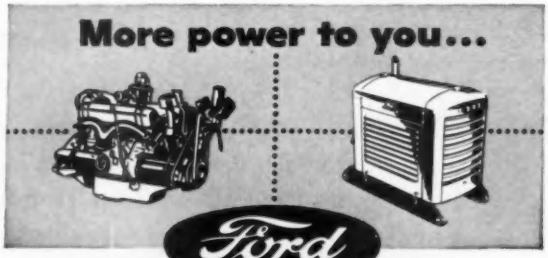
Compactness. All Ford engines offer more horsepower per pound of engine weight than ever before possible. This permits greater freedom of design.

Economy. Ford's overhead-valve construction permits higher engine compression and greater operating efficiency, provides for better breathing, and makes servicing quicker, easier and less costly.

Parts and Service. Ford's world-wide dealer network (over 10,000 Ford Dealerships in the U.S. alone) offers prompt, efficient service for your equipment wherever it goes—including Hawaii and Alaska!

Wide Selection. Ford engines range from 134 to 534 cubic inches. Both carbureted and diesel engines are available as engine assemblies or power units.

For these and other reasons, more and more equipment designers, purchasing agents, sales managers and management are specifying modern Ford Industrial Engines for their equipment. How about you?



Ford
INDUSTRIAL ENGINES
AND POWER UNITS

FORD POWER IS RIGHT FOR YOUR EQUIPMENT, TOO!

INDUSTRIAL ENGINE DEPARTMENT, FORD DIVISION, FORD MOTOR CO., P.O. BOX 598, DEARBORN, MICH.

West of Rockies write to:
FORD INDUSTRIAL ENGINE DEPT., P.O. BOX 6787, LOS ANGELES 22, CALIF.
FORD INDUSTRIAL ENGINE DEPT., P.O. BOX 1666, RICHMOND, CALIF.

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NEWS

FEATURES

GM to Spend $1¼ Billion

Donner Sees Demand for 7 Million '61 Cars

General Motors will spend $1¼ billion in 1961 for plants, equipment, machinery and tooling.

The money will be spent, according to GM board chairman Frederic G. Donner, because GM has "faith in continued free world prosperity." GM spent nearly that amount this year—$1.2 billion—in the same areas and also to bring out the 1961 models.

Mr. Donner told a luncheon of business leaders at the opening of the GM Motorama in New York that GM's forward planning is based on the expectation that new car demand may reach a level of seven million units in the U. S. in 1961, if consumer incomes continue to rise and consumer confidence is sustained. By 1970, he said, demand for passenger cars in the free world will total approximately 16 million units, and demand for trucks nearly four million.

$250 Million Overseas

Of the $1¼ billion earmarked for 1961 spending, approximately $250 million will be spent overseas, where GM now has assets of $1.35 billion. Another $250 million will be invested abroad in 1962.

At a press conference, Mr. Donner broke down the billion and a quarter expenditure into 60 per cent for facilities such as machinery and equipment and 40 per cent for new model tooling. He said the $1 billion domestic outlay is within 10 per cent of GM's record.

About half of the total domestic expenditure will be in Michigan, Mr. Donner added.

The heavy tooling expenditure for new models is in line with GM's policy of annual model changes, or planned obsolescence. President John F. Gordon, speaking at the luncheon, said the pattern of what he prefers to call "dynamic obsolescence" in the automotive industry has spurred the improvement of new cars, made millions of used cars available, and provided better jobs for more people. He said industry does not need to apologize for "dynamic obsolescence."

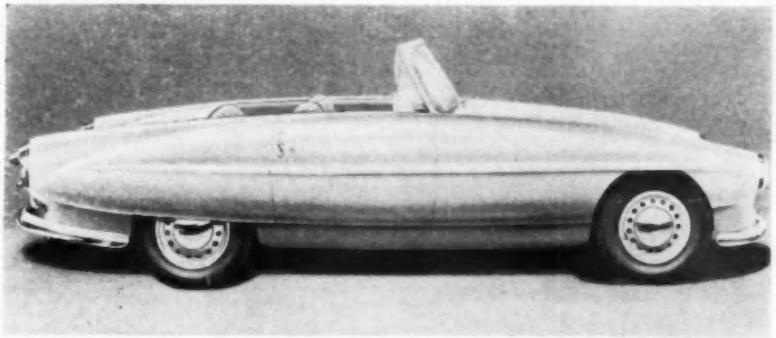
Improved Quality

At the press conference, Mr. Gordon admitted that GM certainly is planning obsolescence, but only on the basis of improving the quality of its product.

He explained that, without an annual model change, car owners would continue to use the same car for a longer period since there would be no incentive to replace it. The result would be a cut in sales, and the lower production volume would raise costs to offset any advantage resulting from not changing models.

He also said there will be changes in smaller cars as the market for these cars increases.

ENGLISH SPORTS MODEL LYNX



First new car to be made by Lea-Francis in 10 years, the Lynx convertible, is powered by three-carburetor Ford Zephyr engine of 158.6 cu in. displacement. Overdrive is standard on the four-speed gearbox.

AI TABLOID

Scientists at the University of Utah are working to isolate and extract vanadium, a commercially-scarce metal vital to the manufacture of shock and heat-resistant steel for jet engine parts and some rocket components. Prof. James M. Sugihara and his colleagues are seeking vanadium in some types of crude oil.

* * *

Development of an implosive shock technique for compound synthesis of certain materials under extremely high temperatures-pressure conditions for short periods is reported in an Air Force materials research study. The technique was used successfully to synthesize boron phosphide.

* * *

The large-scale buildup of foreign investment activities of U. S. companies in recent years has raised the value of their holdings abroad to over $30 billion. U. S. firms added $2½ billion to their investments in foreign subsidiaries and branches in 1959 through capital outflows of $1.4 billion and reinvested earnings of $1.1 billion.

* * *

Four metallurigical reports—one on beryllium evaluation, one on structural damage in Rene' 41, and two on powder metallurgy—have been released to science and industry.

* * *

A molten metal catalyst in a thin film, pressures in the range 0.8 to 1.8 million lb per sq in. and temperatures of 2200-4400 degrees F, are required to convert carbon to diamonds.

* * *

High temperature lubricants and related materials are discussed in two research reports prepared for the Air Force.

* * *

A new technique produces industrial tubing from a variety of metals in sizes from a lead pencil up in rolled strips that can be handled economically and inflated on the job.

More efficient production of tungsten carbide tool tips is possible through the use of the compound in a new high purity powder form produced by a new method.

* * *

A toothbrush made of plastic is so cheap that it can be thrown away after one using.

* * *

Production of tire cord and tire fabric during the second quarter of 1960 was 116,926 thousand lb. This was an increase of less than one per cent over the previous quarter and the comparable period last year.

* * *

Pipe made of a semi-rigid butadiene-acrylonitrile-styrene plastic is successfully replacing stoneware and other resistant materials in chemical laboratory construction.

* * *

The second of two volumes on the analysis of variance has been completed by Air Force mathematicians. Also available are reports on research methodolgy and on the methods and materials aspect of problem-solving.

* * *

A four-year study of ultra high temperatures and a report on the possibility of storing solar energy have been completed by Air Force researchers.

* * *

Test results on materials to withstand a high rubbing speed for 1000 hours at high temperatures are reported in a study. Another report discusses two methods for determining airloads on pointed airfoils and slender bodies at high Mach numbers. Two reports also are available on the part hydrogen plays in metal fracture.

* * *

A total of 3762 Federal-aid highway construction contracts was awarded by state highway departments during the first six months of 1960. They involved a total of $1.5 billion. The contracts averaged $400,000 each.



Dr. Charles H. Moore, of Indianapolis, . Ind., has been appointed technical director of Copper Products Development Association, Inc.

Lockheed Polaris Pact

Lockheed Aircraft Co.'s Missiles and Space Div. has received a $181 million Navy contract for development of longer-range versions of the Polaris missile.

A Lockheed spokesman indicated the firm seeks to extend the Polaris range to 1725 mi from its present range of 1380 mi.

Lockheed said Hercules Powder Co. was awarded a $17 million subcontract as part of the $181 million contract for development of the second stage of the new Polaris system.

Herschel J. Brown, Lockheed vice president and general manager of the Missiles and Space Div., said the latest award brings to $608 million the contracts awarded Lockheed for Polaris research and development since 1956. In addition, the Navy has awarded Lockheed $490 million for production of flight test vehicles and equipment.

Specialists Discuss Materials Handling

Specialists on materials handling in several industrial fields had a get-together recently to exchange data of mutual interest. The occasion was the 7th Biennial Materials Handling Conference, sponsored by Westinghouse Electric Corp., at Pittsburgh.

K. M. Patterson, manager, Headquarters Sales, Westinghouse Electric Corp., set the stage as keynote speaker. In pointing out the importance of materials handling, he said that generally speaking one-third of manufacturing cost was in the materials handling sector. He also put forth the thought that U. S. industry as a whole may not have sufficient low-cost capacity to meet the threat of foreign competition.

An interesting development in cranes—at least one of which has been installed in an automotive plant—was described by W. A. Morey, vice-president of the Whiting Corp. This relatively new overhead-traveling crane employs a positive-displacement hydraulic drive for powering all of its motions. The main pump is driven by electric motor, with the pump mounted on the end of the motor. Besides serving as a power device, the hydraulic motor also acts as a brake for the hoisting gear. The system apparently has worked out very well.

ARMY TESTS ALUMINUM TRACK SHOES



A T-116 carrier equipped with experimental forged aluminum track shoes has undergone severe tests in Alaska with excellent results. The aluminum shoes saved 300 lb in weight and are said to cost less than welded steel shoes.

Borg-Warner Net Down

Higher costs, competition and lower sales held third quarter net income of Borg-Warner Corp. to slightly more than a third of the 1959 figure.

Roy C. Ingersoll, chairman, and Robert S. Ingersoll, president, told shareholders that despite the decline in sales, "Borg-Warner is committed for the largest capital expenditures in its history."

Net dropped to $2,600,291, or 28 cents a share, in the third quarter. The 1959 figures were $7,276,-412, or 79 cents a share. Sales declined to $128,390,277 from $156,-390,427. The third quarter decline cut the nine-month net to $17,839,-366, or $1.96 a share from $25,-556,788, or $2.83 a share. Nine-month sales were $451,458,928 from $484,194,024 last year.

Borg-Warner announced it has formed a Philadelphia subsidiary, Digitronics, Inc., which will specialize in space electronics equipment, digital communications and data handling systems.

GM Income Down

General Motors net income during the first nine months of 1960 was $24 million below last year, despite a five per cent rise in dollar sales. Income totaled $701 million, down from $725 million, while sales climbed from $8570 million to $9064 million.

GM's third-quarter income dropped from $135 million to $89 million, and sales fell from $2345 million to $2201 million. Unit sales for the nine months were 10 per cent ahead of last year, although the third quarter showed a dip.



By DAVID SCOTT • Special Correspondent

Europe's automobile industry is facing a bleak winter.

In Britain, shrinking American sales and continued restrictions on consumer credit at home have deepened the recession.

Vauxhall has 26,000 on a four-day week and has laid off 1000. Ford has eliminated all overtime, and Standard-Triumph has dismissed 700 and put 2000 on a 2½-day week. The British Motor Corp. has a third of its 50,000 workers on short time and has cut production 12½ per cent.

Rover, too, has cut its work week. Smiths, Simms, Wilmot-Breeden and other component manufacturers are similarly hit.

In France, Renault has trimmed daily production of the Dauphine to 1580 from some 2000 in January, and cut both its foreign and domestic prices. Simca is in the same boat, with flagging home sales insufficient to offset export losses.

The German industry is in a better position, having a strong domestic market to absorb the export slack. So far only smaller companies like Hans Glas (Goggomobil) and Lloyd have had to reduce output.

There also is trouble in Italy and Sweden.

American compacts have upset the applecart more violently than anyone expected. The 1961 models were stars of the Paris and London motor shows not only because they were new and technically advanced, but because they are of reasonable dimensions by European standards.

In contrast, there was little new this year from any British or Continental exhibitor.

Thus, European manufacturers are jumpy about the compacts as rivals in other markets besides America. During the Paris show Chrysler International announced plans to double its sales in Europe in the coming year. Target is 30,000, mainly Valiants and Lancers assembled in Holland and Switzerland.

English Ford will be among those to suffer from the recent launching of the Falcon in Australia, built there with 90 per cent local content. Saving on import duty will class the Falcon with GM's Holden, and enable it to undercut British, French and German cars of smaller size and power.

Rootes' New Plant

Yet despite these setbacks, none of the European car makers has revised large-scale expansion plans. Latest announcement comes from Rootes, which intends to build a factory in Scotland to produce an entirely new and smaller Hillman. The $60 million project will be completed in two years, with initial output 150,000 cars annually.

Ford, Vauxhall and Standard are going ahead with their schemes for new plants near Merseyside in the Liverpool area. B.M.C. also is spreading out into that district, still looking ahead to the 1,000,000 production mark by 1962.

Daimler-Benz is extending its capacity, and in the first half of this year took on 3000 extra workers, boosting output to over 470 Mercedes daily. German Ford, having launched its restyled Taunus 17M, is seeking a site for an additional plant.

Foreign operations also are growing. Standard-Triumph has just opened an assembly plant near Brussels, putting the British company inside the European Common Market. Leyland intends to build a factory in Israel making Diesel trucks of seven tons and over. Borgward is planning a plant in Scotland.

Long-term optimism about the future is the basis for these projects. Speaking at the 30th anniversary ceremonies of the Ford Cologne factory in October, Henry Ford II forecast that Europe will absorb six million vehicles a year by the end of this decade—double the present number. Most manufacturers here share this view.

The British regard the present economy dip at home as merely cyclical. The industry is campaigning to ease the local sales tax and curbs on time payments that suppress real demand for cars, believed to be vast.

There are still some 1½ million autos more than 10 years old in the country, and compulsory inspection of these elderly machines early next year is expected to put many of them off the road, and thus stimulate sales.

Among technical developments, Smiths is working on a low-cost air conditioner for small cars that uses water evaporation instead of vapor compression refrigeration.

Precise Meshing

Simms has developed a starter motor featuring precise meshing of the pinion and ring gear as opposed to crash engagement. A special engagement armature advances the pinion into mesh, and withholds it until teeth are perfectly aligned.

King's Heath Engineering has introduced a hydraulically-operated cold roller for forming brake shoes from heavy T-section steel. Changeover to different sized formers is said to take only eight minutes.

Allis-Chalmers Sales 25 Pct. Less Than '59

Sales of $126.6 million during the third quarter were 20 per cent lower than in the preceding quarter and 25 per cent under the 1959 figures, R. S. Stevenson, president of Allis-Chalmers Mfg. Co. reported to stockholders. Earnings per share this year were 96 cents as compared with $1.69 in 1959.

"This decrease is attributable to lower farm equipment and construction machinery sales," Mr. Stevenson said. "Shipments of electrical and industrial apparatus were slightly higher than during the comparable 1959 quarter. This sharp drop in volume reduced net profit to $1,251,383 after taxes."

Mr. Stevenson reported the backlog of unfilled orders stands at $29.6 million, down somewhat from the $241.7 million in 1959.

Chrysler Earnings Up

Chrysler Corp. earned $1.4 million or 15 cents a share in the third quarter. This was the first profit for Chrysler in that period since 1957. Last year Chrysler had a loss of $34.2 million in the third period.

Third quarter sales climbed 48 per cent to $634.1 million from $432.9 million a year ago.

At the end of the first nine months, Chrysler had net income of $25.1 million, or $2.84 a share, an increase of 5.4 per cent from the $23.8 million, or $2.73 a share for last year's nine months.

Chairman L. L. Colbert told stockholders that Chrysler's retail sales in the first nine months accounted for 15.7 per cent of all domestic car sales, an increase from the previous year's 12.3 per cent.

FIRST PHOTO OF ARMY SURVEILLANCE PLANE



Grumman Mohawk with SLAR gear provides permanent aerial radar map of terrain on either side of flight path. The SLAR (side-looking-airborne-radar) system provides radar photographic maps which can be developed in seconds.

Acquisition Approved

Stockholders of White Motor Co. and Oliver Corp. have approved the sale of Oliver's farm equipment business to White. They also approved a proposal that White have a two-year option to buy Oliver's crawler tractor division. In the meantime, White will act as sales agent for that division's products.

Under terms of the acquisition, Oliver will receive 655,000 shares of White common stock, valued at $48.50 a share, or $31,767,000. Any difference between this amount and the purchase price based on determination of fixed assets and inventories as of Oct. 31 will be paid in cash. J. N. Bauman, White president, said this payment is expected to total between $5 and $6 million.

The acquisition is expected to add $80 million to White's annual sales, which amounted to $333 million last year.

Plants acquired by White are at Charles City, Ia., Battle Creek, Mich., and South Bend and Shelbyville, Ind.

Oliver still has the Cleveland tractor plant; a Guilroy, Calif., plant making hydraulic equipment and land leveling machines, and a York, Pa., plant where conveyors are made.

Parker-Hannifin

Parker-Hannifin Corp. earned a net profit of $393,520 on sales of $10,778,180 for the third quarter. These figures compare with $768,889 earnings on sales of $12,753,136 for the 1959 period.

Earnings for the three months were equivalent to 30 cents a share as compared with 59 cents last year.

C. C. Sigmier, chairman, and S. B. Taylor, president, said they expected the company's aircraft and missile business to show gains in both sales and earnings for the remainder of the year.

NEW *EMRALON*® TFE COATINGS SOLVE HEAT SENSITIVE APPLICATIONS

Acheson's resin-bonded tetrafluoroethylene (TFE) surface coatings are finding ready acceptance among design engineers. Where previous limitations of pure TFE prevented its application on heat sensitive substrates, because of its 700° F. sintering temperature, 'EMRALON' coatings are being successfully used on rubber, light metals, woods, and plastic. One such impressive case history is outlined here.



'EMRALON' coating is shown being spray-applied on woven belting with conventional equipment.

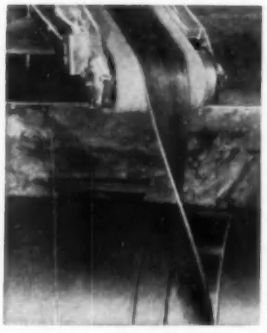
OVER $15,000.00 ANNUAL SAVINGS PROJECTED BY PROMINENT TIRE MANUFACTURER

Dunlop Tire and Rubber Corporation, Buffalo, N. Y., estimates this considerable savings in down-time costs alone on the basis of nearly nine months production use of an 'EMRALON'-coated belt conveyor. The particular belt involved is thirty feet long. Its importance in this company's tire production is emphasized by the fact that it is located at the point of a previous bottleneck. Rubber strips, conveyed from a series of masticating mills to an extruding press, formerly became stuck to the belting of this short-run conveyor immediately above the final masticator. The reason: the temperature of the rubber is elevated — through friction of the masticating process — to between 150° F. and 300° F. at this point. Belts had to be replaced anywhere from once every several hours to every six weeks. It was not unusual to have two or three stoppages every shift. The result: with the supply of rubber temporarily cut off, the entire department shut down. Costs ran $5.00 a minute, and with these work stoppages averaging 20 minutes each, the accumulated expense became prohibitive. Since April, 1959, the new belt has been in constant operation at this critical point in the masticating line.

To date it has not been removed from the mill . . . ample proof of the extraordinary non-stick, adhesion and flexing qualities of its 'EMRALON' coating!

The woven conveyor belt is a product of Globe Woven Belting Company, Buffalo, N.Y. Application of Acheson's 'EMRALON' to their belting was the outcome of a continuing research program headed by Globe Research Manager, Fred Kohlhagen. It is applied by standard commercial spray equipment to a film thickness of 0.7 mils and then oven-cured at a temperature of 300° F.

According to Mr. Kohlhagen, "This example will be only one of many success stories told about this coating. 'EMRALON'-coated belting can be used anywhere a slick, non-corrosive belting is needed. Those in the baking, canning, food processing, food packaging, and rubber fields should find immediate use for it." We might add that there are many other industries finding it advantageous to use 'EMRALON' . . . yours quite possibly is one of them. Why not write today for further information?



'EMRALON' — coated conveyor belt carrying hot rubber through masticating mill.

'EMRALON' ADVANTAGES PROVED IN MANY LIGHT-LOAD USES

The growing list of production applications for the new Acheson 'EMRALON' surface coatings, is convincing proof of their versatility. That film pack, office machine, and lock mechanisms; rubber molds and oil seals; bakery dough handling equipment and countless other light load, solid-film lubrication problems have successfully been answered, is now a matter of record.

With 'EMRALON' 310* — colloidal TFE in a phenolic resin solution — a one-hour cure at 300° F. is all that is necessary. And, for substrates even more sensitive to heat, 'EMRALON' 320** colloidal TFE in a thermo-plastic resin carrier — is available. Both provide excellent adhesion, low coefficient of friction, flexibility, toughness, and corrosion resistance. Applied by conventional paint spray equipment, they allow easy production line conversion to 'EMRALON' solid-film lubricants.

'EMRALON' coatings represent the latest in a long line of widely accepted Acheson products, one of which may offer a ready-made answer to your particular lubrication problem. We welcome the opportunity to be of service. Send for your copy of our Products List which outlines the full line of Acheson Dispersions. Address Dept. AI-110

*'EMRALON' 310 is manufactured under exclusive license from E. I. duPont deNemours & Company (Inc.) under U. S. Patent 2,825,706. Not licensed for use or for sale for use in providing electrical insulation.

**'EMRALON' 320 — patent applied for.

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MEN IN THE NEWS



Midland-Ross Corp., Surface Combustion Div.—Carl W. Sisco has been appointed manager of steel mill equipment.



Budd Co.—Fred T. Roberts has been promoted to manager of wheel products sales.



Electric Autolite Co., Industrial Instrument Div.—Thomas B. Murchie has been promoted to head an expanded sales program.



Controls Co. of America, Electron Div.—Robert Hansen has been promoted to sales and marketing manager.



Norma-Hoffmann Bearings Corp.—Patrick R. Condon has been appointed sales engineer.



Oakite Products, Inc.—William A. Baltzell (far left) has been elected vice president and J. Justin Basch has been elected second vice president.

Taylor Fibre Co.—**Harry L. Hildebrand** has been promoted to manager of process and design engineering, and **John G. Musselman** has been appointed manager of Fabricating Div.

E. W. Bliss Co., Mackintosh-Hemphill Div.—**Edward P. Sandbach** has been promoted to manager of manufacturing.

Borg-Warner Corp., York Div.—**T. J. Ammel** has been named sales manager, O. E. M. and mobile products.

Waukesha Motor Co.—**Clarence J. Caldwell**, 43-year veteran in the Personnel and Purchasing Departments, has retired.

Dana Corp., Fort Wayne Div.—**R. E. Woodcock** has been named manager.

Walker Mfg. Co., Automotive Wholesale Div.—**George C. Matteson, Jr.**, has been named marketing manager.

Link-Belt Co.—**Roy E. Lambert** has been promoted to manager of Indianapolis ball and roller bearing plant.

Baldwin-Lima-Hamilton Corp., Industrial Equipment Div.—Leon Mollick has been named manager of engineering.

Ford Motor Co., Engine and Foundry Div.—**Arthur R. Nash** has been named production programming and control manager.

Eimco Corp., Tractor-Loader Div.—**Leon H. Bates** has been promoted to plant manager.

International Harvester Co., Motor Truck Div.—**P. A. Tiffin** has been named supervisor.

Cincinnati Milling Machine Co., Products Div.—**William G. Bancroft** has been named manager of grinding. wheel plant.

Republic Aviation Corp.—**Harry A. Pearl** has been named supervising engineer of the materials laboratory.

Allis-Chalmers Mfg. Co.—**C. F. Codrington** has been named manager of engineering for the pump and compressor department.

Humble Oil & Refining Co., Esso Standard Div.—**Bernard J. Heiart, Jr.**, aide to seven of eight Esso presidents, has retired after 44 years' service.

Studebaker-Packard Corp., Automotive Div.—**Charles R. Weaver** has been promoted to vice president.

Imperial Brass Mfg. Co.—**Martin J. Butler, Jr.**, has been appointed manager of marketing services.

S. K. Wellman Co.—**Paul H. Henning** has been appointed industrial relations director.

Parker-Hannifin Corp., Valve and Crown Div.—**Kurt W. Leibfritz** has been promoted to chief engineer, air valves.

Goodyear Tire & Rubber Co., Metal Products Div.—**Robert J. Burns** has been promoted to general manager.

Ex-Cell-O Corp.—**Fred T. L. Grim** has been promoted to director of purchases.

Clinton Engines Corp., Maquoketa Div.—**Thomas A. Dreis** has been named comptroller.

Hyster Co., Industrial Truck Div.—**William C. Brewer** has been named supervisor of advertising and sales promotion.

Ford Motor Co.—**Julius J. Harwood** has been appointed manager of metallurgy department of the Scientific Laboratory.

Necrology

Harry Ferguson, 75, noted farm equipment inventor and former partner of the late Henry Ford, died Oct. 25 in Abbotswood, Stow-on-the-Wold, Gloucestershire, England.

Raymond J. Keirn, Jr., 40, assistant manager of Chrysler Corp.'s Sales Div., died Oct. 24 in Royal Oak, Mich.

John T. Trumble, 80, pioneer automotive engineer, died Oct. 22 in Detroit. He was chief engineer for Welch Motor Car Co., Little Motor Car Co., Sampson Tractor Co., Olds Motor Works and the F. B. Sterns Motor Car Co.

Francis G. Greene, 65, retired traffic director of Gar Wood Industries, died Oct. 22 in Detroit.

Alexander T. Galbraith, 76, retired vice president of Crucible Steel Co., died Oct. 19 in New Rochelle, N. Y.

Walter S. Talmadge, former treasurer of International Harvester Co., of Canada, died Oct. 8 in Hamilton, Canada.

(Advertisement)

RBW FASTENER BRIEFS

RUSSELL, BURDSALL & WARD BOLT AND NUT COMPANY



Technical-ities

By Fred E. Graves

Fastening of "blind hole" joints

Holes which don't go all the way through a solid member must be tapped, of course. In shallow, small holes, in non-critical fastening, and in soft materials thread cutting screws work well and save time.

But fastening large flanges, pressure plates, heads and the like to costly castings needs more precise production. These holes are ¼" diameter and larger, affect design strength.

THREAD EFFECTS

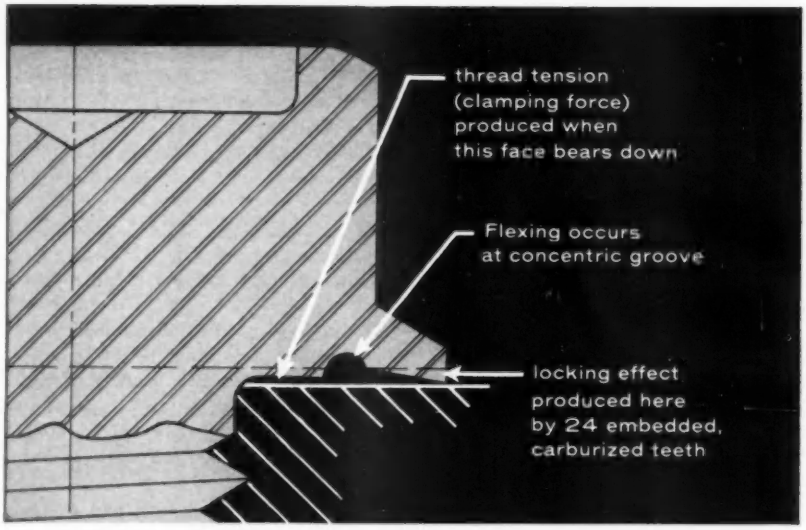
Such holes are coarse threaded. The coarse threads develop more thread strength than do fine threads, also take fewer turns in assembly. Studs go into the holes with an interference thread fit; hex screws with a simpler clearance fit.

Desirably, studs should all be driven to same depth and bottomed. Because of normal manufacturing differences, various mismatched high and low tolerances will cause studs to project unevenly. Assemblers often have to juggle. No such problem exists with hex screws. You just tighten to specified preload. And there's no double driving operation, as with stud plus nut.

STRENGTH OF BLIND JOINTS

Tapped holes behave like nuts. Their threads adjust elastically and plastically to distribute stress and develop high thread tension. Is this harmful in repeated disassemblies? Not at all. Hex screws have been installed 50 times in cast iron test blocks, then tightened to failure without damage to tapped holes.

Clamps like a hex screw Grips like an anchor



Tensilock® screws offer you the ideal combination of high clamping force and high locking power.

While a standard high strength hex screw can be tightened to a higher thread tension, its off-torque is less than its on-torque.

ANCHORED IN PLACE

The *"Tensilock"* screw features ratchet action teeth formed at an angle which will cut driving effort to permit you to utilize more of the full strength of screw. At equal driving torque, it not only develops 90% of the strength of a high strength hex screw but also takes *25% more torque to loosen than to tighten.*

Because of the flange's concentric groove, it flexes, allows the screw to bear down solidly on its seat and develop a high level of thread tension. At the same time the teeth embed themselves, are aided in maintaining their grip by pressure of the spring-action flange.

MAKES GOOD FRICTION-TYPE JOINT

Clamping force from Tensilock fasteners is sufficient to prevent slippage of fastened members where holes are oversize or eccentric. Grip of the teeth keeps fasteners tight under conditions of vibration or cyclic temperature changes. RB&W *"Tensilock"* Nuts also available. Write for Bulletin TL-2. Russell, Burdsall & Ward Bolt and Nut Company, Port Chester, New York.



® Registered and Patented

Plants at: Port Chester, N. Y.; Coraopolis, Pa.; Rock Falls, Ill.; Los Angeles, Calif. Additional sales offices at: Ardmore (Phila.), Pa., Pittsburgh; Detroit; Chicago; Dallas; San Francisco.

an Editorial



"Making Production Pay"

NOW THAT THE ELECTIONS ARE OVER, business can expect everyone to start thinking more about jobs, work, and every practical matter. One of the most important problems that should be put uppermost on the schedule is industry's continuing task of "MAKING PRODUCTION PAY."

IN THIS INDUSTRY, it is obvious that in every branch and division 1961 models and products have exceptional style and customer appeal. They have functional improvements galore. They have convenience and utility appeals which have real value for any prospective buyer. The industry's response to America's needs is greater than could have been anticipated by any forecaster. Automotive leaders are confident of sales success.

NOW IT IS TIME to make certain that the industry can be equally confident of success in reducing costs and improving profits. The key to future growth and expansion is the extent to which production can be made to pay necessary and adequate profits.

THE NEEDED GAINS in profits can be obtained by the entire industry and by individual plants and divisions. In studies of production materials now available from major producers, there are important opportunities for significant savings in materials costs which can be obtained at the same time that improved materials are used. It is the duty of this magazine to bring such opportunities to the attention of both design and production engineers continuously. We will certainly do so.

THERE ARE IMPORTANT AND SIGNIFICANT GAINS which can be made in reducing manufacturing costs—in every branch of metalworking. Some of these savings could make it possible to convert uneconomic operations into profitable production. It is the duty of this magazine to bring these examples to the attention of our readers. We will certainly do so.

AN ARGUMENT FREQUENTLY ENCOUNTERED concerning the reasons for continuing high cost operations is the complaint that top management resists change. During visits with top executives on recent plant tours, top management men were asked why such complaints exist. The answers, in the aggregate, appeared in an interesting pattern. To sum up the answers, we were told that "Management never resists a change which will make production more profitable." In other words, management can find the money, if production engineers can really prove that proposed changes will actually produce better profits.

THE COMBINED IMPRESSION was received that 1961 may be a year of more progress in production modernization than has been typical of any recent year since 1955. One company alone is spending more than $300,000 this fall merely to familiarize every corporate executive with the specific opportunities for "Making Production Pay" throughout the entire organization. This is certainly an indicator that "Production Economy," as a theme, is well on its way to becoming an industry-wide concept for 1961. We wish these planners every success in their ventures. This leadership is the kind of forward thinking which has enabled the automotive industries, traditionally, to lead the industrial field in America to new and higher peaks of both volume and profit.

Hartley W Barclay

Editor and Publisher

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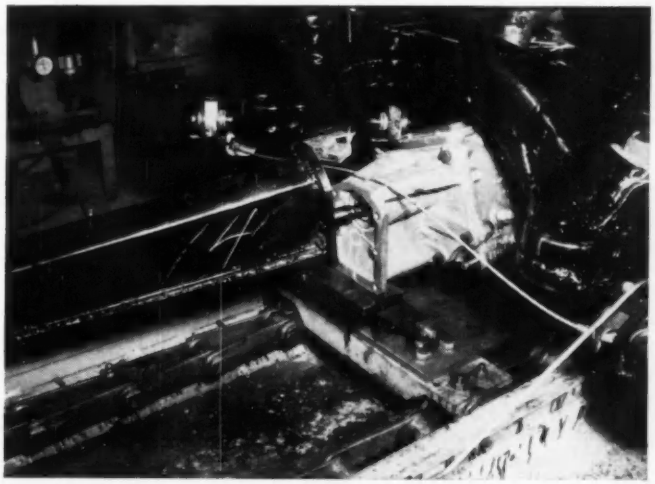
Unique Production Methods for Pontiac Tempest Driveshaft

By Joseph Geschelin
DETROIT EDITOR

Including a description of how the four-cylinder single-bank engine block is machined on the V-8 line

THE long, slender torsion bar driveshaft used in the Pontiac Tempest has been the subject of discussion in many quarters since the details of the car were released early in September. Surely it is a unique experience in the engineering field to find a design element of such novelty that no counterpart seems to exist in the literature. Although Pontiac is not yet ready to release an engineering analysis of this torsion member, let us assure our readers that it does work and it does have adequate endurance. This has been demonstrated in the course of several millions of car miles on the roads and proving ground; and in continued testing in the laboratory.

While this article is concerned with the processing of driveshafts, some comment on the design of the shaft is pertinent. In manufacture the shaft is handled substantially along the recommendations in the SAE Manual on torsion bar springs. There are differences of course. For example, one of the most important features here is to produce driveshafts straight within very close limits. This is accomplished in a

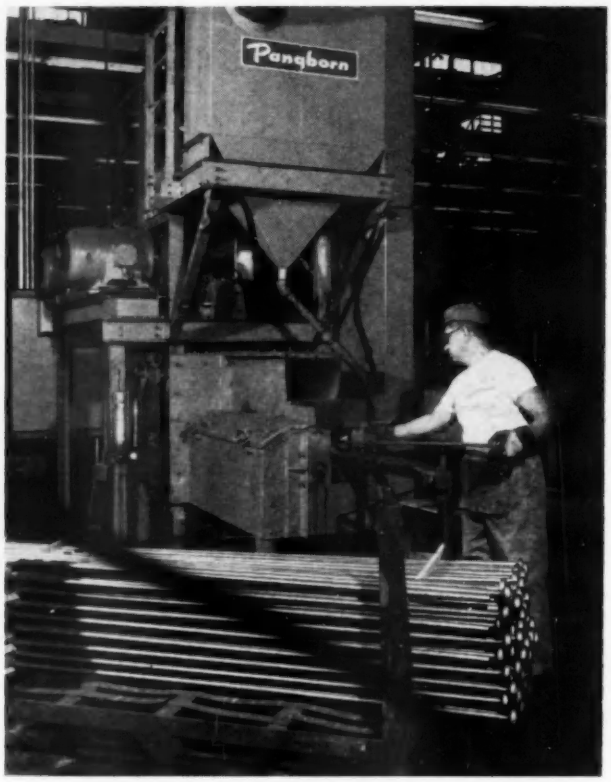


Insertion of the drivshaft at the transaxle end to produce the camber in the shaft. The torque tube then is securely attached.



Installation of the four-cylinder Tempest powerplant, together with the torque tube and one end of the slender driveshaft.





Above—Normalizing and annealing, before machining, are handled in these two pit-type Lindberg furnaces. The method of loading a large number of shafts at a time is shown clearly in this view.

Right—The special Pangborn Rotoblast machine does double duty on the driveshafts. It is used for shot-blasting following annealing; then for shot peening after heat treatment.

number of stages as will be shown presently.

There is a compelling reason for this procedure. At assembly the shaft is coerced into a cambered form due to the inclination of both engine and transaxle axes at an angle of 11 deg. This applies a bending moment at each end of the shaft. Consequently, the driveshaft is subjected to combined stresses consisting of the bending moments plus shear due to torsion loading.

It will be interesting to study the stress analysis of this shaft. In addition to the resolution of stresses due to torsional loading, bending moments and end moments, it is necessary to investigate critical speeds and torsional resonance since they have an effect upon the stability of the camber and freedom from any tendency to whip at rotative speeds within the speed range of the vehicle. Stability of the camber coerced by the end moments is a basic feature since it means that the shaft undergoes reversals of stress each revolution with fiber stress changing from compression to tension during each revolution.

This unusual combination of stress loading accounts for the following processing cycle and the insistence upon close control of each step.

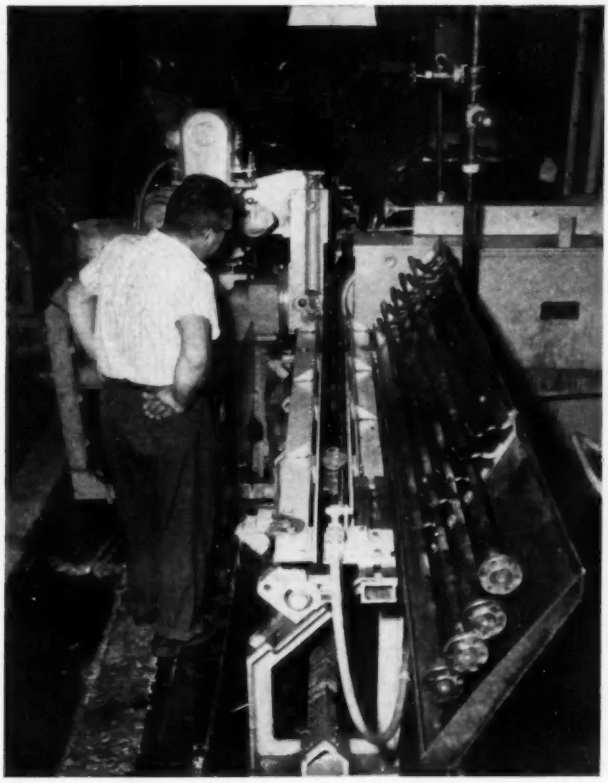
Tempest driveshafts come in two sizes—$\frac{5}{8}$-in. diameter for automatic drive; $\frac{3}{4}$-in. diameter for manual shift transmission. They are approximately 80-in. long, the $\frac{3}{4}$-in. shaft being about five inches shorter than the one for the automatic drive. Due to the requirements of almost infinite endurance limit, the shafts are forged from SAE 8660 alloy steel. The forging has a small-diameter flange on one end, and a bearing and spline at the opposite end.

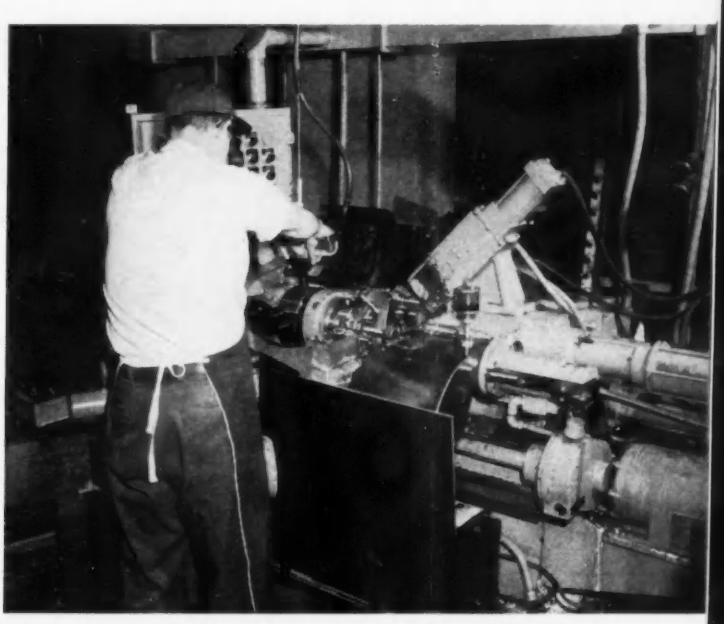
Rough forgings are normalized and annealed in two pit-type Lindberg furnaces. For this operation a number of shafts are placed in a special rack to facilitate loading and unloading in the furnaces.

Then they are transferred to a Pangborn Rotoblast machine designed for handling the long parts. This machine is used for two separate operations: massive shot blasting following annealing, to remove all scale; and shot peening after the machined shaft has been heat treated. Naturally, the machine settings are changed for each of these operations.

After shot blasting the shafts move into the machining department. First operation is straightening in a special Impco machine in which straightening is accomplished by means of roller pressure at a number of points. Then the shafts are cut to length, to an accurate gage, in an automatic DoAll saw.

Now comes the grinding of the shaft diameter in a special abrasive belt type centerless grinder supplied by Production Machine Co. The cycle is arranged to grind automatically in two successive passes, removing approximately 0.040-in. of stock on the diameter. This is followed by a wash.





Above—Forming and finishing of the driveshaft flange is accomplished in the special Seneca Falls lathe shown here. The double tailstock and intricate tooling, described in the text, may be seen at the right.

Left—View of one of the Production Machine Co. special belt type centerless grinding machines for the driveshaft. The horizontal abrasive belt may be seen at the right, the regulating belt being at the left.

Next the shafts go to a special Seneca Falls automatic lathe for forming and finishing the flange end. Although this machine looks simple, it has a complexity of unusual functions. For example, the tail stock has two spindles which cycle automatically. The first spindle cuts the center in the flange end; then the head moves over to present the live center for holding during machining. The tail stock also has an angularly-mounted overhead tool head for forming the flange. Supplementing this is a tracer-controlled tool holder for machining the upset area at the flange.

The opposite end, containing the bearing and diameter for the end spline, is machined by tracer control in a special Pratt & Whitney automatic lathe. The P & W lathe too has the double-cycle tail stock for preparing the center, then centering for machining as in the case of the first lathe.

This is followed by rolling the splines in the now familiar Roto-Flo spline rolling machine with automatic cycling.

These operations complete the so-called rough machining stage and the shafts return to the heat treating department. Here they are heated at a temperature of 1550 F for one hour, are automatically dropped into an oil quench, then drawn in a large Sunbeam unit at a temperature of 725 F for two hours.

Shafts return to the machining department where they are first straightened to close limits by a hand method. This is followed by finish-grinding.

The first step is finishing the entire length of uniform diameter in another of the Production belt-type centerless grinders. The abrasive belts are of fine grit size selected to produce a surface finish of 50-microinch (rms).

At this point the shafts are put through a large Magnaflux Magnaglo inspection unit, a 100-per cent inspection. Due to the complex of stress loading neither surface nor sub-surface imperfections can be tolerated.

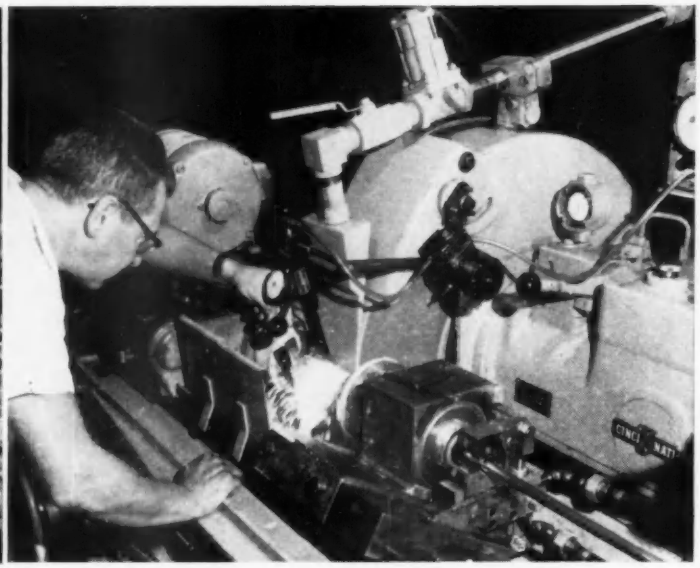
Following this the shafts return to the Pangborn machine for shot peening, then are subjected to the third and final machine straightening operation.

Final operations consist of finish-grinding at the flange and at the bearing on the opposite end. The bearing end is finish-ground in a Cincinnati external grinder. Grinding limits are held to 0.0005-in. on the OD. In addition, surface finish is held to 10-20-microinch (rms). To meet these requirements the grinder is equipped with an Arnold gage on the work, communicating with a Federal precision gage over the bed. The latter adjusts the grinding head automatically to maintain the required tolerance.

The flange end is finish-ground in a Landis angular head grinder which finishes the pilot diameter as well as the outer flange face. This grinder too employs the Arnold gage. (*Continued, next page*)



The bearing and diameter for the end spline on the driveshaft are turned in this special Pratt & Whitney automatic lathe with double tailstock.



Bearing end of driveshaft is finish-ground in this Cincinnati grinder. The Arnold gage may be seen in the center, the Federal gage overhead at the extreme right.

This completes the sequence of operations, all of the shafts being subjected to final inspection before transport to the final assembly department.

Since the shaft is fully enclosed within the torque tube, it does not require chemical surface treatment or paint. However, each shaft is sprayed with a plastic coating to protect against corrosion.

MACHINING THE FOUR-CYLINDER SINGLE-BANK ENGINE BLOCK

While we are on the subject of the Tempest, we thought it might be of interest to find out how the four-cylinder block is machined and what had to be done to the transfer machine line to permit handling of a single bank block.

As noted in the car description, the single-bank engine is exactly the same as the V-8 block, except for elimination of the LH bank and a few minor details. Consequently, close cooperation between engineering and factory management made it a relatively simple matter to accommodate the single-bank block on the V-8 line. The situation does place emphasis upon the initial planning of a major transfer machine line, cooperatively between engineering and manufacturing. The original line had ample provision for the installation of additional heads and some of these spaces were needed in the present situation. Finally it may be noted that the introduction of some new heads and changes in wiring at certain key points were accomplished through the cooperation of the machine builders.

The cylinder block machine line for the V-8 block, which has been in use for a number of years, consists of a roughing section and finishing section, the latter being associated with the operations following assembly of main bearing caps. The roughing section consists of two duplicate lines of Ingersoll and Greenlee transfer machines. Here they have set aside one line exclusively for the V-8 block, while the other line handles both blocks, scheduled in batches.

One detail was required to make this possible—the addition of a V-locator on the single-bank block

(*Turn to page* 136, *please*)



Tempest driveshafts must be free from any surface imperfections. The final check is made in the familiar Magnaflux inspection machine.

How Bendix-Westinghouse Tests Diaphragms for Air Brakes

By E. W. P. Smith
Metallurgical Engineer
Bendix-Westinghouse
Automotive Air Brake Co.
Elyria, Ohio

NOT a single one of the many parts used in automotive air brake systems should fail. The thin flexible synthetic rubber coated fabric diaphragms used in valves and switches must be as reliable as the rigid, thicker metal parts. To assure maximum reliability, Bendix - Westinghouse subjects a fabric considered for use as a diaphragm to exceptionally severe and extensive tests that are probably more comprehensive than those employed on fabric by any other industry.

The tests here described were conducted in connection with design modifications, which included new diaphragm material for six units—two emergency valves, a pressure regulator, a brake valve, a relay emergency valve, and a trailer emergency stop light switch

One of the problems experienced with previous material was wicking—this is air seepage occurring at high pressures through the fabric of the diaphragm.

What was wanted was a fabric of excellent anti-wicking properties, without loss of any of the other properties desirable for the application — strength, flexibility, and high and low temperature performance within the range —65 to +200 F.

Among a number of fabrics suggested by different suppliers, a Buna N coated nylon fabric, specially developed for this use by Vulcan Rubber Products Division of Reeves Brothers, Inc., appeared to meet the requirements most closely. This fabric was subjected to the gamut of B-W test procedures to check the manufacturer's specifications and to ascertain its serviceability under operating conditions. It was then adopted for production.

Adhesion Test. Adhesion requirements are a minimum of 10 lb per inch of width. The rubber coating is pried loose at the edge of a sample with the help of a razor blade. Coating and base fabric are then inserted in a tensile tester to register the tension needed to pull off the coating. In many cases, the samples could not be stripped, indicating the ultimate in coating to fabric adhesion.

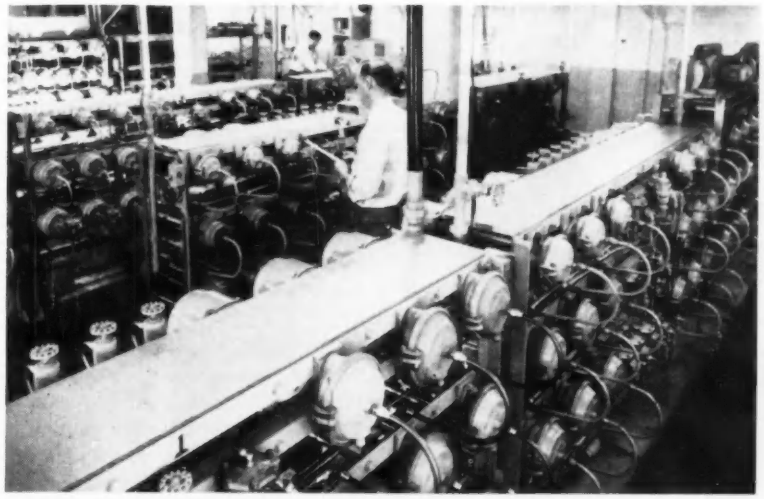
Thread Count and Fabric Weight. These two factors can be checked after stripping of the coating. Thread count is made both in fill and warp direction. Weight is registered in ounces per square yard.

Fabric Material. This is done by using the visual, chemical, and/or microscopic tests of ASTM Tentative Method D276.

Coating Material. The rubber is checked by flame and odor tests and is compared with known specimens to determine the general class of rubber; i. e., whether it is natural rubber, neoprene, SBR, Buna N, etc.

Oil Resistance. This is an important property in diaphragm coating, since it may be exposed to engine and lubricating oils present in compressed air. Many rubbers deteriorate in contact with oil. The samples are immersed for 70 hours in standard ASTM #1 and #3 oils at 212 F. Then the total percentage of volume change of complete diaphragm material is measured. Permissible limits for this application are —15 percent to 0 in ASTM # 1 oil and —5 percent to +5 percent in ASTM #3 oil.

(*Turn to page* 108, *please*)



Special life-test room at Bendix-Westinghouse provides facilities for testing several hundred air brake units simultaneously

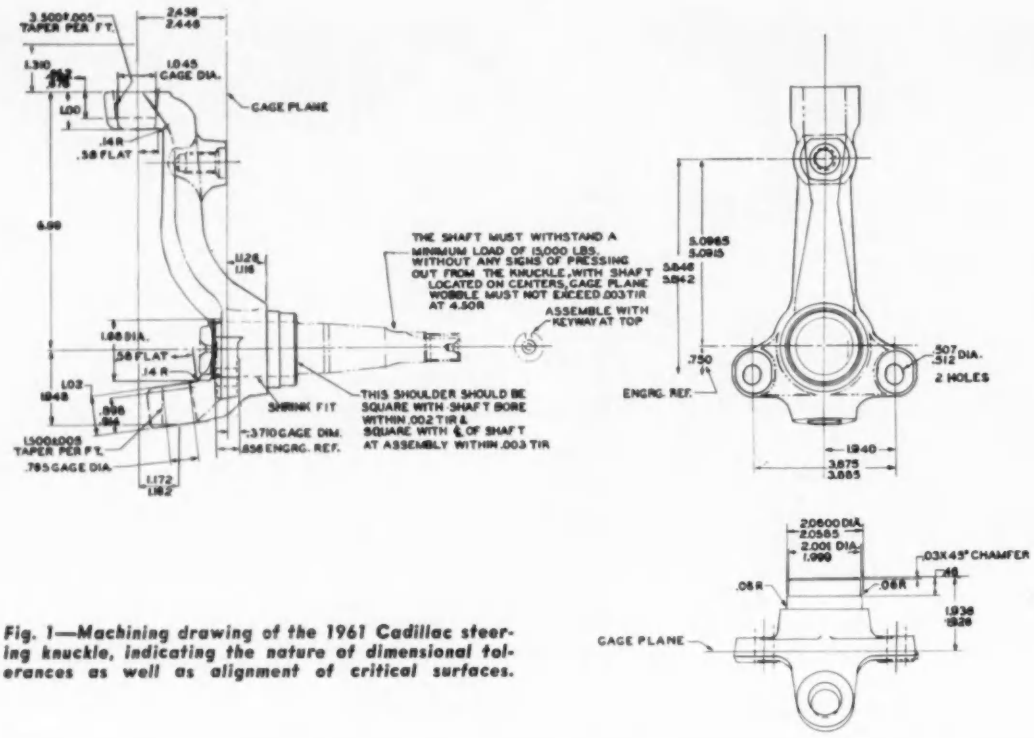


Fig. 1—Machining drawing of the 1961 Cadillac steering knuckle, indicating the nature of dimensional tolerances as well as alignment of critical surfaces.

Latest Production Methods for 1961 Cadillac Components

By Joseph Geschelin
DETROIT EDITOR

NUMEROUS engineering advances in the product have led to higher quality levels, tighter manufacturing tolerances, and many improved production methods at Cadillac. One of the most dramatic of Cadillac engineering developments for 1961 is the lubrication-free chassis, stemming from the adoption of rubber bearings in the entire suspension system together with spherical ball joints in the front suspension.

As a result the front suspension is entirely new, and features new parts with tighter dimensional tolerances and a fresh concept for the assembly of the suspension as well as its installation in the chassis.

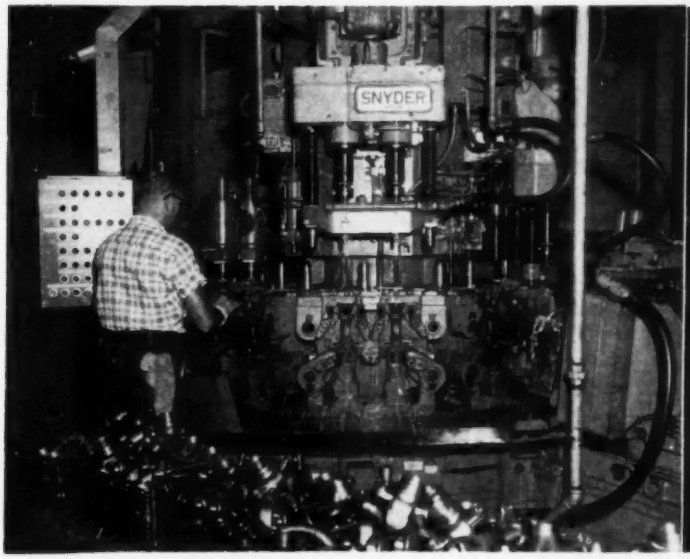
Steering Knuckle

A noteworthy feature of the front suspension is the new steering knuckle shown in Fig. 1. Cadillac practice is to make the knuckle in two pieces—the yoke section, and the precision spindle. The drawing reproduced here indicates the nature of manufacturing tolerances as well as the control of critical mounting locations. To assure the maintenance of these tolerances Cadillac has installed some new items of equipment designed and tooled for this specific function.

As will be shown presently, there are three principal items of equipment for machining knuckles: two Snyder center column, 8-station drilling and milling machines; and a two-spindle Ex-Cell-O precision-boring machine. In the Snyder machines the parts are loaded in pairs onto the indexing table where they are securely clamped to preserve the alignment of critical surfaces. In addition, as a machining head approaches the fixture two massive locator bars enter the locating holes in the fixture to assure proper alignment of the head and fixture at each station.

In preparation for machining the knuckle forgings are heat-treated, quenched, washed, and tempered to a Brinell hardness of 217-255. They are then coined, inspected, and transported to the machine shop.

The sequence of operations in the first Snyder machine is:



Close-up of one of the two Snyder, center column indexing machines on the steering knuckle line. This is a view of the loading station, showing a right- and left-hand knuckle securely clamped in the indexing fixture.



Here is the heating station where steering knuckle forgings, after machining, are induction-heated to expand the large bore for the spindle. The operator is seen in the act of pressing the spindle in place by hand.

Station	Operation
1	Load and unload
2	Drill two holes; drill anchor pin hole; spotface spindle hole boss
3	Hollow-mill spindle boss diameter; rough-mill upper tapered hole boss
4	Spotface two mounting hole bosses and one anchor pin boss; drill taper hole halfway; drill spindle hole
5	Core-drill spindle hole; tap drill one hole; drill upper stud hole
6	Core-drill spindle hole; finish-mill upper stud hole boss; ream one hole
7	Finish hollow-mill 2.055-in. diameter; semi-finish spindle boss; rough taper-ream upper ball stud hole; tap one hole
8	Semi-finish-ream spindle hole; ream two mounting boss holes; finish-ream upper ball stud taper hole

The part is completely inspected, then is transferred to the second operation Snyder machine for the final machining steps. The sequence of operations in this machine is as follows:

Station	Operation
1	Load and unload
2	Rough straddle-mill lower ball stud boss
3	Finish straddle-mill lower ball stud boss
4	Rough face-mill one side of upper ball stud boss; drill lower ball stud hole
5	Finish face-mill side of upper ball stud boss; rough taper-ream lower ball stud hole
6	Counterbore and chamfer spindle hole diameter
7	Finish taper-ream lower ball stud hole
8	Idle

It is worthy of comment that the Snyder machines mentioned above are very massive and rigid. This feature is essential in maintaining the fine tolerances that are specified. Too, Cadillac management feels that for the numbers involved here, the center column machine represents a considerable space saving when contrasted with an in-line machine for the same sequence of operations.

Final operation on the knuckle is the precision-boring of the spindle bore to 1.500-1.501-in. and chamfering in the two-spindle Ex-Cell-O machine.

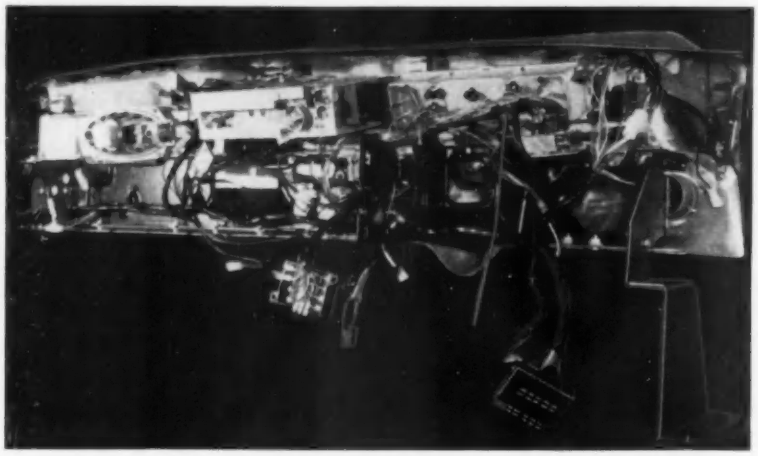
Meanwhile, the precision spindle is prepared in another department, then is transported to meet the knuckle in the area we have described. The finish-machined knuckle forgings now are induction-heated to expand the spindle bore; then the spindle is pressed in by hand and held to cool. Reference to Fig. 1 will show that after this severe press-fit operation the spindle shoulder must be square with the shaft bore within 0.002-in. total indicator reading and free from wobble as indicated.

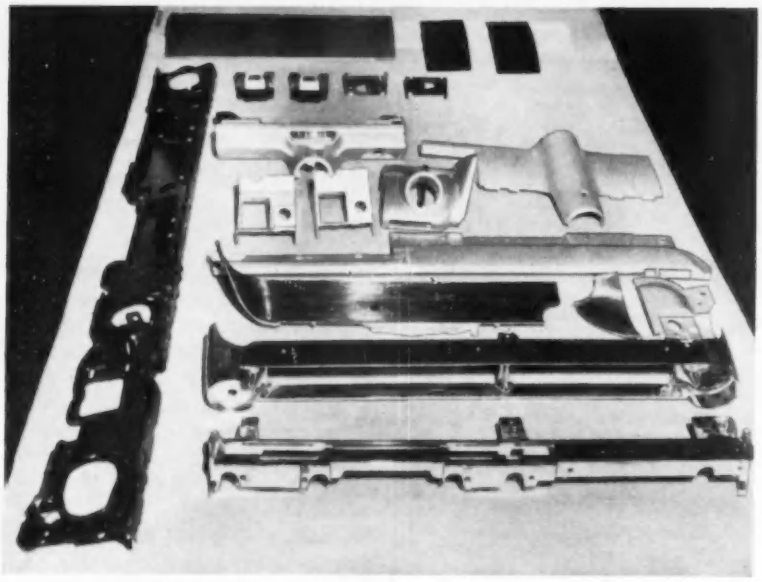
This procedure provides steering knuckles of exceptional quality to serve as the backbone of the front suspension system.

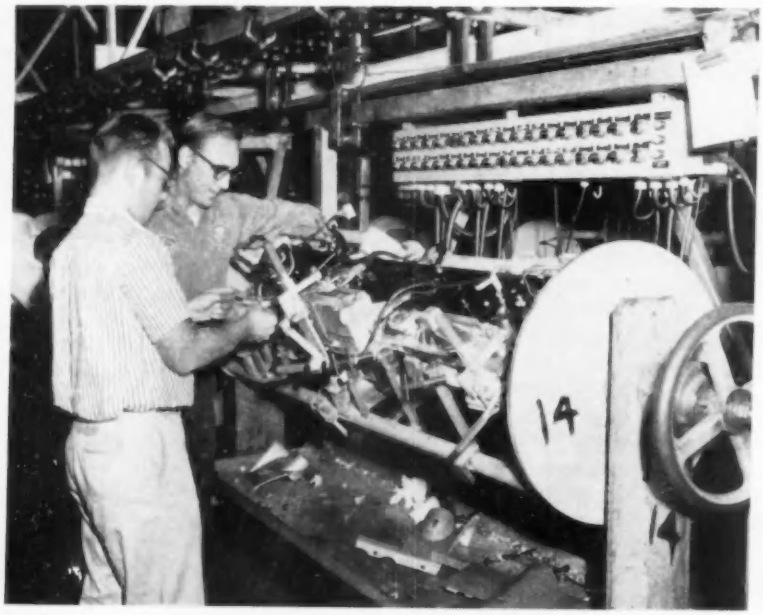
Front suspension assemblies are prepared on a new assembly conveyor, illustrated here. At the end of the line there are four special machines designed for pre-setting the caster and camber of each unit. This adjustment is made by means of a single eccentric bushing with a tapered OD, the exact setting being effected accurately with the aid of suitable gages. The exact setting for each unit it marked by a code number, later employed in shimming the suspension to suit an individual chassis frame up the final assembly line.

Instrument Panel

Cadillac is particularly proud of its new instrument panel and the provisions for producing the assembly. The 1961 instrument panel is exceedingly complex. It is an assembly of a variety of components —instruments; zinc die castings; aluminum stampings, the large







glove compartment and the two ash trays made up of unique aluminum extrusions; radio; air conditioning system elements and controls; and some intricate wiring harness. All of these components are tied securely to the massive sheet metal backbone stamping.

This assembly is organized in orderly stages, employing an expanded version of the merry-go-round conveyor line, described in AUTOMOTIVE INDUSTRIES in connection with similar assembly operations on previous models. The current merry-go-round line has been expanded to 25 stations on the line, six stations off the line.

A noteworthy feature of the merry-go-round fixtures this year is the provision of an electronic console so arranged as to make it possible to check the wiring of subassemblies at any stage and the final check-out of the completed wiring harness. It provides a rapid and infallible check on each instrument panel assembly before the assembly leaves this department.

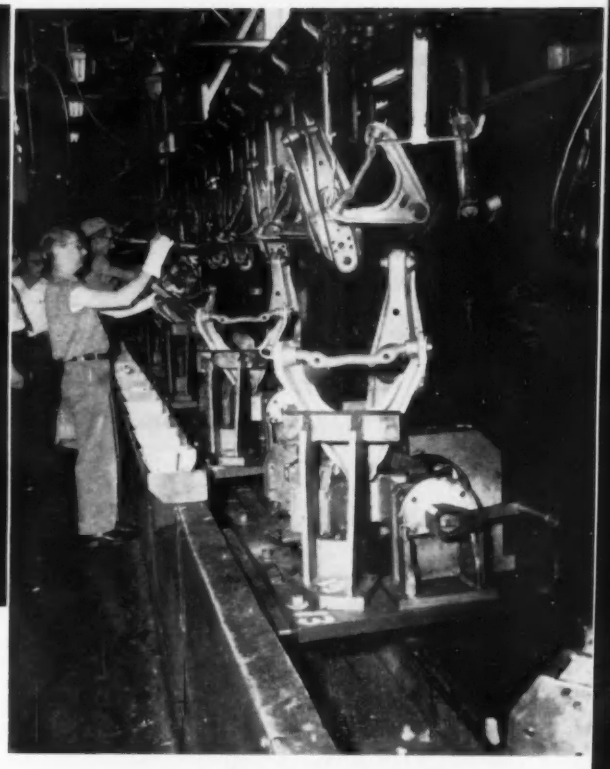
TOP—
The 1961 instrument panel has become a complex of components, accessories, electrical connections, and wiring harness. This view of the back side of the panel provides a good picture of hidden details.

MIDDLE—
The instrument panel is as complicated from the front as it is from the back. Here we see an exploded view of the major components that make up the panel (less the accessories such as radio, speedometer, gages, etc.). The large piece on the left is the backbone of the panel and is a precision-made steel stamping. The three pieces at the top are special aluminum extrusions for the glove compartment door and the two ash trays. Immediately below are four smaller steel stampings. The remaining parts are zinc die castings.

BOTTOM—
Close-up of one of the 25 fixture stations on the instrument panel assembly line. The panel with all accessories and wiring is integrated progressively as the fixture moves from station to station. Attention is drawn to the electronic check-out panel mounted above the assembly fixture. It is connected electrically to the panel and will read any sub-assembly or complete assembly to assure freedom from faulty connections or operation before the panel is installed in the car.



As the finished front suspension assembly comes off the line (with the brake assembly as the backbone) it is transferred to one of four machines, as illustrated here. This machine is employed for the pre-adjustment of camber and caster.



Perspective of the assembly line for front suspension units. Parts and sub-assemblies are delivered on the overhead conveyor seen directly over the line. The assembly is prepared in the massive fixtures seen in the foreground.

Front and Rear Suspensions

In keeping with the reliability program now in effect, extra precautions are taken on the final assembly line to assure proper alignment of front and rear suspension assemblies in the chassis. Since it is not economically feasible to maintain the same order of close tolerances on the large chassis frame, suitable gages are provided on the final line for the accurate alignment of the suspension assemblies. This is done by shimming at each point to the dimensions indicated by the gages.

As noted earlier, both camber and caster adjustments of the front suspension are pre-set before installation on the final line. There remains the problem of making the correct adjustment for toe-in at the end of the final assembly line. This is done with an advanced type of instrumentation developed by GMR. Toe-in adjustment at the front end is made with the front wheels rotating under power. At the same time the overall alignment with rear wheels is made to assure proper steering of the entire vehicle. To this end, the rear wheels rest on pivoted shoes, instead of being fixed as heretofore. The adjustment, therefore, takes into account any relative misalignment between the front and rear wheels.

Shifting to another area of management activity, it is of interest that the Reeves variable drives for the principal conveyor lines have been relocated on platforms where the mechanism not only is readily accessible but does not take up useful floor space. Besides this, each unit now has a new stand-by unit installed on the same platform as insurance against costly down time. ■

GM Pension Benefits Total $80 Million

In a single decade some 33,000 retired hourly rated employes in General Motors U. S. plants have received $80 million in pension benefits. And currently, more than 350,000 active employes are building retirement benefits under the company's pension plan.

The program for hourly rated employes was instituted in October, 1950, under terms of a contract with the United Auto Workers. GM bears the cost of the pension plan, and funds are held and invested by six banks acting as trustees. The funds can never revert to the corporation.

Of the 33,000 who retired since the program began, 25,000 still are living and receiving benefits.

An employe retiring now with 35 years' service would receive a GM pension of approximately $72. If he is 65, his Social Security check would raise his monthly income to $191. Hourly rated employes may retire anytime between 60 and 68 and, if they have at least 10 years with GM, receive the pension benefits.

Under GM's salaried employe pension plan, 8600 have received retirement benefits and 120,000 are building toward pensions. GM began a contributory program for salaried employes in 1940 and added a non-contributory section in 1950.

MODERN STEELS *for* LIGHTER AUTOMOBILES

By M. W. Lightner
Vice President, Applied Research
UNITED STATES STEEL CORP.

TABLE A

PROPERTIES OF THE HIGHER STRENGTH STEELS
Hot Rolled* Sheet

	Yield Point, psi	Tensile Strength, psi	Elong. in 2", Minimum, %	180° Cold Bend Diameter, min.
USS COR-TEN	50,000 min.	70,000 min.	22	1t
USS TRI-TEN	45,000 min.	60,000 min.	25	Flat
USS MAN-TEN MODIFIED	45,000 min.	70,000 min.	22	1t
USS PAR-TEN	45,000 typical	62,000 typical	29 typical	Flat
USS EX-TEN	50,000 min.	—	—	—
USS "T-1"	100,000 yield strength, min.	115,000/135,000	*B	2t

* Except for "T-1" steel which is a heat-treated grade

TABLE B

COMPARISON OF SQUARE BOX MEMBERS OF EQUAL STRENGTH

	Carbon Steel	"T-1" Steel	6061-T6 Aluminum Alloy
Weight	1	.30	.29
Deflection	1	3.33	3.50
Material Cost	1	.60	2.50

TABLE C

COMPARISON IN BENDING OF SHAPES MADE FROM VARIOUS HOT-ROLLED STEELS AND FROM USS "T-1" HEAT-TREATED STEEL

	Minimum Yield Point, psi	Relative Thickness Required	Relative Weight	Relative Cost	Relative Deflection
Carbon Steel	30,000	1.00	1.00	1.00	1.00
USS COR-TEN	50,000	0.80	0.80	0.89	1.66
USS TRI-TEN	45,000	0.67	0.67	0.98	1.50
USS MAN-TEN MODIFIED	45,000	0.67	0.67	0.83	1.50
USS EX-TEN 50	50,000	0.60	0.60	0.72	1.66
USS "T-1"	100,000*	0.30	0.30	0.60	3.33

* Yield Strength

TABLE D

COMPARISON IN BENDING OF SHAPES MADE FROM COLD ROLLED SHEETS

	Yield Point, psi	Relative Thickness Required	Relative Weight	Relative Cost	Relative Deflection
Carbon Steel	25,000	1.00	1.00	1.00	1.00
USS COR-TEN	45,000	0.56	0.56	0.83	1.79
USS TRI-TEN	45,000	0.56	0.56	0.83	1.79
USS MAN-TEN	45,000	0.56	0.56	0.76	1.79
USS EX-TEN	45,000	0.56	0.56	0.70	1.79

WHEN it comes to spending money for construction, we want our dollars to buy the *most* strength and the *least* weight. This is the idea that United States Steel has been working on, and we believe that accomplishments so far are well worth the serious attention of automotive engineers and designers.

And, while we were about the job of increasing strength and reducing weight, we have also managed to come up with greater economy. Up till now we have done this mostly in large stationary structures and in railroad freight cars —by using modern higher strength steels in advanced designs. Recently, a little experience with truck parts has demonstrated that similar results can be obtained in lighter mobile equipment, and we see no reason why modern higher strength steels cannot be used to decrease the weight of automobiles.

Many of these modern higher strength steels have been available for a good many years, and you are probably familiar with such names as USS COR-TEN, TRI-TEN, MAN-TEN, and certainly with PAR-TEN. Other grades are new —such as USS EX-TEN high-strength low-alloy steel, and USS "T-1" constructional alloy steel. Some of the properties of these

grades are shown in Table A.

As you know, hot-rolled and cold-rolled plain-carbon steels now used in the automobile industry have yield points of from 25,000 to 30,000 psi. They have high ductility. The cold rolled sheets have the good surface-finish especially required for the light-gage external parts of automobile bodies. These steels are *good* and have given excellent service for a very long time. But as shown on the table, the newer steels now available have yield points of 1½ to over 3 times those of the carbon steel, and these new steels could be used for strength members and interior body framing to replace the lower strength steels now being used.

In fact, the steel industry can supply more than 30 steels of the high-strength, low-alloy type that have minimum yield points of 45,000 to 50,000 psi. And they come in a wide variety of forms, such as cold-rolled sheets, hot-rolled sheets, plates, structural sections, and many special sections.

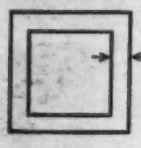
In addition to higher strength, these newer steels have good formability and good weldability. They can be readily fabricated by the methods now in use. But, so far, the only place they have been used extensively in passenger cars has been in bumpers, a use which began, in quantity, about 10 years ago. They are now used for bumpers on about 40 per cent of American-made cars, and have reduced bumper weight by 15 to 20 per cent. A saving of that sort would amount to a considerable weight reduction if it were possible to attain it throughout the automobile.

To get back to our subject, higher strength steels, a new member has been born into this modern steel family—this is the very high-strength heat-treated constructional alloy steel known as USS "T-1" steel. It has 100,000 psi yield strength, exceptionally high strength-to-weight ratio, and remarkable formability for a material with such high strength. It is also readily weldable. This steel has already made its mark, and is destined for a great career.

Naturally, these higher strength steels have somewhat less formability than the lower strength carbon steels, and the designs for those parts that require exceptionally high formability would undoubtedly have to be modified to accommodate the steels. However, parts that do not require such high formability could be formed from these steels without changing present practices. We realize, of course, that there are certain parts of the cars, such as fenders, that are without question beyond the forming capacity of these steels.

Now, I'd like to illustrate in a simple way how these modern higher strength steels can be used to obtain weight savings. (Fig. 1) Here is a box-shaped member of

FIG. 1



BENDING STRENGTH IS PROPORTIONAL TO $f \cdot S$

STIFFNESS IS PROPORTIONAL TO $E \cdot I$

DEFLECTION IS PROPORTIONAL TO $\frac{1}{E \cdot I}$

WHERE f = YIELD POINT OF THE MATERIAL

S = SECTION MODULUS

E = MODULUS OF ELASTICITY

I = MOMENT OF INERTIA OF THE SECTION

FIG. 2

$$f_a S_a = f_b S_b$$

$$S = \tfrac{4}{3} t D^2$$

$$f_a \left(\tfrac{4}{3} t_a D_a^2\right) = f_b \left(\tfrac{4}{3} t_b D_b^2\right)$$

$$f_a t_a = f_b t_b$$

$$\frac{d_a}{d_b} = \frac{f_a}{f_b} \frac{E_b}{E_a}$$

t = Thickness

f = Yield Point

d = Max. Elastic Deflection

E = Modulus of Elasticity

FIG. 3

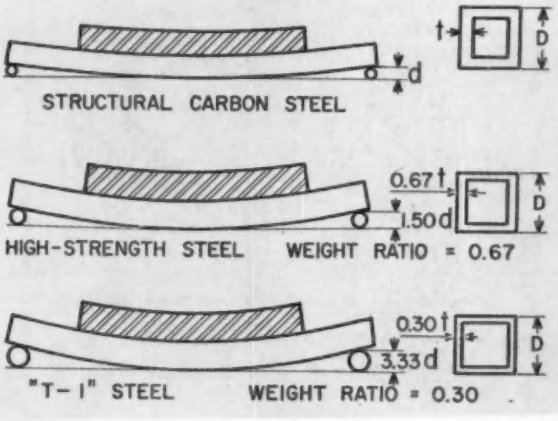
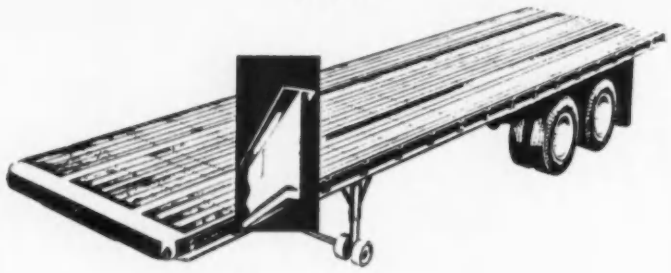


FIG. 4



given height, width and wall thickness. As we know, the strength in bending is proportional to the yield point of the material times the modulus of the section. The stiffness of the section is proportional to the modulus of elasticity and the moment of inertia. Deflection, of course, is proportional to the reciprocal of the stiffness.

Now let us assume that we have two of these box-shaped sections—each with the same height and width. And let us identify the properties of one material by the subscript "a" and those of the other material by the subscript "b." (Fig. 2)

Since the bending strength is the product of the yield point and the section modulus f.S, in order for these two sections to have equal bending strength

$$f_a \cdot S_a = f_b \cdot S_b$$

Now $$S = \frac{4}{3} tD^2$$

and substituting in the first equation

$$f_a \left(\frac{4}{3} t_a D_a^2\right) = f_b \left(\frac{4}{3} t_b D_b^2\right)$$

Since

$D_a = D_b$, we end up with $f_a \cdot t_a = f_b \cdot t_b$

or as you increase the yield point you can decrease the thickness in the same proportion.

In the same way, it can be shown that deflection is directly proportional to the yield point and inversely proportional to the Modulus of Elasticity—thus the ratio of the deflections of these same two materials is shown by the expression

$$\frac{d_a}{d_b} = \frac{f_a}{f_b} \cdot \frac{E_b}{E_a}$$

The appropriate values for yield point and modulus of elasticity may be substituted in these formulas to obtain a comparison of members made from different steels or even from nonferrous materials. (Fig. 3)

If the box-shaped members have equal bending strength and equal depth, the weight of the high-strength low-alloy steel member with 45,000 psi yield point is 67 per cent that of the carbon steel member with 30,000 psi yield point. And when it comes to "T-1" constructional alloy steel with its 100,000 psi yield strength, the weight is only 30 per cent. Either of these is an important weight reduction. As shown in Fig. 3, the deflections of the tubular members made of the higher strength steels are greater than those made of carbon steel, being in direct proportion to their yield points. In this example, the high-strength low-alloy steel member deflects about 1.5 times as much as the carbon steel member, and the "T-1" steel member about 3 times as much as the carbon steel.

Now as to cost—for hot-rolled material, the cost of USS MAN-TEN steel in this member, for example, in relation to carbon steel, is 83 per cent, and of "T-1" steel, less than 80 per cent.

Next, let us make a comparison with a nonferrous material, aluminum. The high strength-to-weight ratio of "T-1" steel gives a re-

FIG. 5

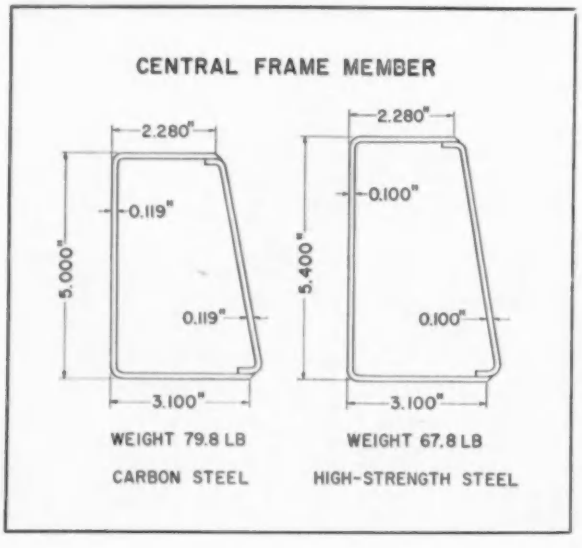
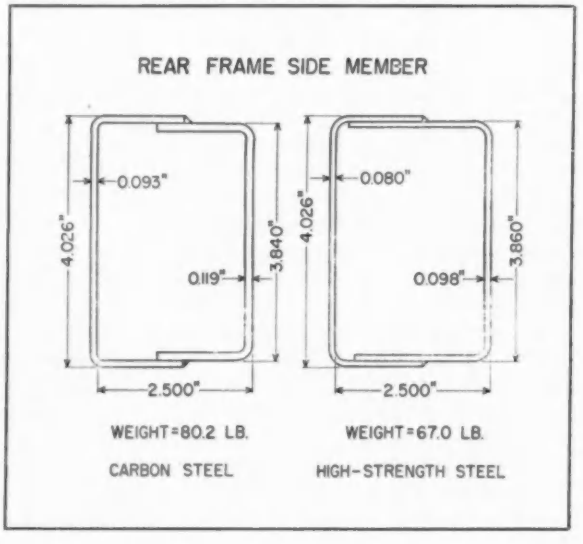


FIG. 6



markable parallel with the structural aluminum alloy 6061-T6. (Table B) Again we compare square box members of equal depth and bending strength. Both members weigh about 30 per cent as much as the carbon steel member. Likewise, both deflect over three times as much (3.33 for "T-1" steel and 3.50 for the aluminum alloy). But, when it comes to costs—there the parallel ends. While the "T-1" steel costs about 20 per cent less than the carbon steel, the aluminum alloy 6061-T6 costs about 2.5 times as much as the carbon steel, and 3 times as much as the "T-1" steel.

The conclusion is clear. Higher strength steels can be used to get weight reduction, at essentially no cost increase—while on the other hand, these same weight savings can be attained with nonferrous materials but at a substantial increase in cost.

There are certain limiting factors that must be considered in the use of higher strength steels for structures. In the box-shaped example it was shown that structural members made of these steels, or of aluminum, deflect more than carbon steel. Also, because of the thinner walls, members are more susceptible to local buckling. Therefore, most designs, to be practical, will be a compromise between weight savings and cost savings on the one hand, and, on the other, stiffness and local buckling.

In a trailer frame (Fig. 4), we got a weight reduction of 25 per cent by using main supporting beams fabricated with USS "T-1" steel flanges, welded to a USS COR-TEN high-strength low-alloy steel web member. This brought the weight of the trailer down from 12,800 lb to 9700 lb, a reduction of 24 per cent. A large number of these trailers have been built over the past 3 years.

Admittedly passenger-car bodies and chassis are not heavy duty trailers—quite probably the weight savings would be less in the lighter vehicles. However, many of the design principles used in the truck-trailer can be used in the lightweight members of the automobile. With correct design and fabrication, a great deal of weight can be saved in passenger cars without increasing production costs.

Suppose we look at a comparison of weight and cost savings that could be obtained, if we substitute higher strength steels for plain carbon steel sheets.

In Table C we see the relative thicknesses, weights, and costs of hot-rolled carbon steel, contrasted with several high-strength low-alloy steels, and USS "T-1" heat-treated constructional alloy steel. As you can see, for equal bending strength, carbon steel shows up as actually the most expensive material. By substituting the high-strength low-alloy steels, we save from 10 to over 25 per cent in cost and about 40 per cent in weight.

Even more dramatic is the weight reduction we get when we use USS "T-1" steel in place of carbon steel. For equal load-carrying ability in bending, weight can be reduced as much as 70 per cent by using "T-1" steel. And, although "T-1" steel costs more per pound, its use in efficient design would lower cost as much as 20 per cent.

At present, "T-1" steel is not produced in thicknesses below 0.100-inch; therefore, it is not now economical for replacement of carbon steel in the thicknesses used for automobile bodies. However, as our processing facilities are improved, we hope to produce "T-1" steel in thicknesses down to 0.040-inch, which will be suitable for many of your applications.

Now, you can't ordinarily get these cost and weight savings by merely substituting one of the modern high strength steels for plain carbon steel because, in most auto-

(*Turn to page* 86, *please*)

Fig. 7

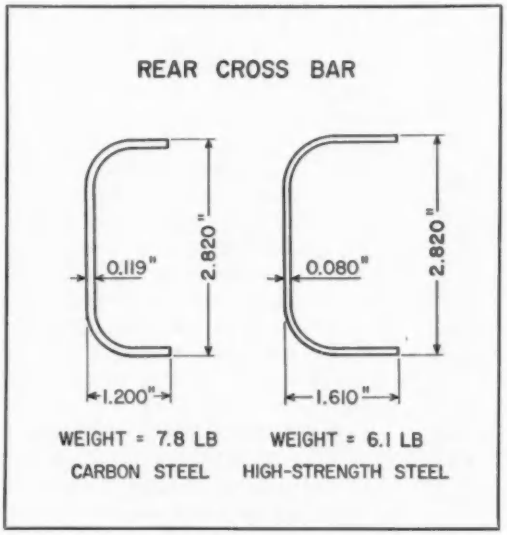
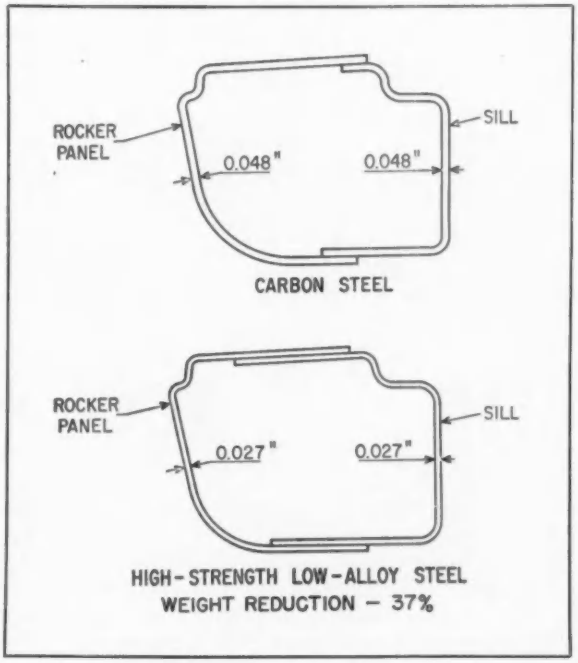
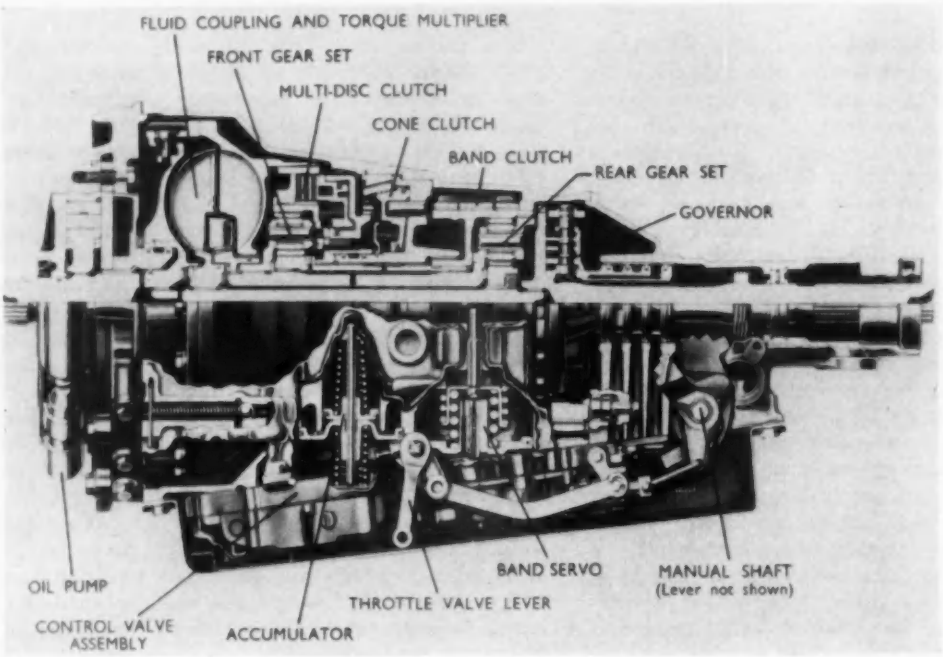


FIG. 8





Sectioned diagram of the small Hydra - Matic transmission fitted to the Vauxhall Cresta and Velox models.

London Motor Show Reflects Consolidation of British Industry

By David Scott

BRITISH CORRESPONDENT

THIS year's London Motor Show in October was the largest ever, in the absence of house trailers and motorboats which now have separate exhibitions. Concentration on cars at Earls Court was on a record scale, with 360 models displayed by 33 British companies and 37 manufacturers from nine other countries.

Since 1959 was a vintage year for the British automobile industry, it is not surprising that there were few new models on show, for the past twelve months have been a period of consolidation. Principal developments were in the field of sports cars, and Berkeley introduced the small Bandit, with styling and quality finish aimed at the American market.

Built on a 6-ft, 10-in. wheelbase, the two-passenger car features extensive use of Ford components, including the Anglia 60.84-cu in. engine, gearbox and final drive. All wheels are independently sprung, with the Ford solid axle modified to take swing axles, the cut-down half-shafts being universally-jointed to the differential shafts.

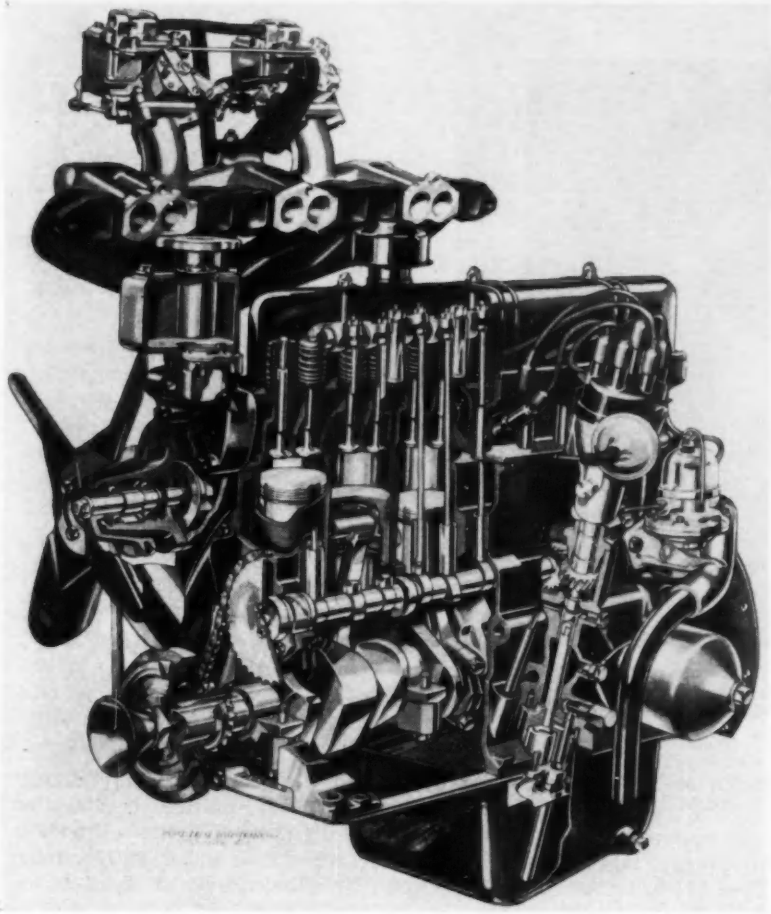
Rear wheels are located by two tubular radius arms and sprung by coil springs. Front suspension is of the MacPherson strut-type similar to that used on all the English Ford models, and wheels are braked by Girling disks.

The chassis is a complex sheet steel structure braced for torsional rigidity by a reinforced fiberglass floor pan that is rivetted to it to form a rigid assembly. Berkeley has specialized in fiberglass for both cars and trailers, and employs this material for the Bandit body.

With the Lynx roadster the 64-year-old Lea-Francis Company has returned to the British motoring scene after an absence of 10 years. The engine is a modified Ford Zephyr unit with three carburetors, and develops 107 hp at 4500 rpm. Drive is through a Moss four-speed gearbox and hypoid axle. Front wheels are sprung by longitudinal torsion bars housed in the tubular frame members, and Dunlop disk brakes are used on all wheels. The open four-seat body of torpedo form is of all-steel construction except for aluminum doors, hood and trunk lid.

Jensen presented a completely restyled version of its sports sedan, the 541S, whose body is enlarged for additional width and headroom to seat four people in comfort. The power plant is a B.M.C. 243-cu in. six-cylinder engine, and a Hydra-Matic transmission, built in Britain by Rolls-Royce, is standard equipment. A Powr-Lok limited-slip differential also is standard equipment. The chassis has tubular frame members, one of them being used as a vacuum reservoir for the servo-assisted Dunlop disk brakes used all around. Body is fiberglass.

Rootes offered the Sunbeam Alpine sports car with an enlarged 97.1-cu in. engine that now develops 85.5 hp at 5000 rpm. Among other improvements in this model are adjustable accelerator, clutch and brake pedals to suit requirements of individual drivers, and the elimination of eight grease points by the use of sealed universal joints and of nylon inserts in the



Standard's new six-cylinder engine for the Vanguard sedan has twin semi-downdraft carburetors and a header tank on the cylinder head to permit the use of a shallow cross-flow radiator. Output of the 122-cu in. unit is 80 hp at 4400 rpm.

tie rod joints and upper steering knuckle bearings.

Standard introduced an entirely new six-cylinder engine for its Vignale Vanguard four-door sedan. Although the 122-cu in. unit has slightly less displacement than the old four-cylinder engine, its maximum output of 80 hp (net) at 4400 rpm is 12 hp more. This gain is achieved mainly by a higher (8 to 1) compression ratio and dual carburetors.

The twin Solex semi-downdraft carburetors are of new design, being angled at 45 degrees for a saving of up to 4 in. in overall height. The inlet manifold is aluminum and the exhaust iron, and an unusual arrangement for limited hot-spot contact and clamping overcomes the problem of the different expansion rates of the two metals.

Standard has effected further space economies by discarding cylinder liners in this latest design, thereby limiting its length to 28.3 in., or only 1.5 in. more than the four-cylinder engine despite the two extra cylinders. Another point of interest is the separate header tank on the cylinder head so that a shallow cross-flow radiator can be used.

Following the recent introduction of an enlarged six-cylinder 113-hp engine for its Velox and Cresta, Vauxhall presented the small Hydra-Matic transmission built by GM's Detroit Transmission Division for the Oldsmobile F-85 compact. This features a small torque multiplier to boost acceleration in initial take-off, mechanical drive in the middle ratio, and load shared between the fluid coupling and multi-plate clutch in top.

The transmission adds only 30 lb to the weight of the Vauxhall cars, and is expected to be adopted by Opel in Germany for the similarly-powered Kapitan.

Rover displayed its 3-liter sedan with power steering made by Hydrosteer of Luton. Servo mechanism and cam-and-lever gear are integrated in the housing, with a double-faced piston coaxial with the worm spindle and engaging the rocker shaft. The forward end of the spindle is coupled to the coaxial valve spool through a ball race, and the valve is in a neutral position and oil circulates freely when no pressure is applied to the steering wheel.

Slight end-float of the spindle permits axial movement and thus displacement of the valve spool when steering pressure is exerted, thereby directing the hydraulic flow to the side of the piston that will assist movement of the rocker shaft in the required direction and

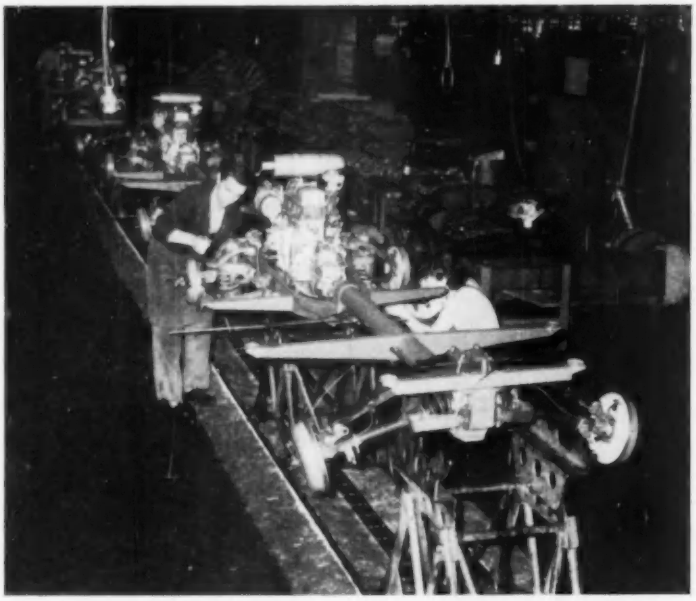
(*Turn to page* 110, *please*)



Jensen 541S has an enlarged and restyled body, B.M.C. 254-cu in. engine, Hydra-Matic transmission, Powr-Lok differential and disk brakes.

Czech Plant Tooling for Rear-Engined Car

By David Scott
BRITISH CORRESPONDENT



Chassis assembly line at theSkoda car factory, where waist-high carriers advanced by drag chain ease access to the tubular-backbone structure. Women make up nearly half of the 10,000 workers at the plant.

A RECENT visit to the Skoda car factory at Mlada Boleslav revealed that Czechoslovakia's principal automobile plant has virtually completed the first phase of its major expansion program—the partial retooling of the existing factory. The second phase is the construction of an entirely new factory on adjacent ground, and the introduction of a completely new model that will ultimately replace the Skoda Octavia.

Current output, including chassis for special bodies, is about 210 daily. Initial target, set for 1963, is over 300 a day or some 100,000 a year of both the old and the new cars, after which production of the Octavia will taper off as total output increases beyond that level.

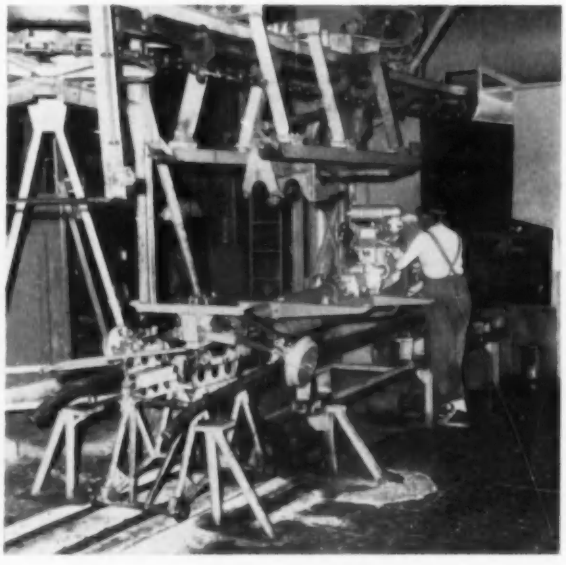
The future model, it is understood, will have the same 7-ft wheelbase as the present one but with a four-door and slightly larger body, unitized construction making it 400 lb lighter. Engine is rear-mounted, and is an aluminum four-cylinder unit of about 60 cu in. displacement. It is inclined to one side to lower the body line.

Buildings for the new factory are now being erected from prefabricated concrete sections, and comprise shops for machining, body stamping and welding, painting and assembly. While a great deal of new equipment is scheduled for installation, most of the modern machines and production lines from the old plant will be moved in. The latter will then be converted for the manufacture of non-current spare parts, tools and specialized machine tools.

The complexities of such a move in normal circumstances are compounded by the difficulties facing the Czech automobile industry. It is handicapped by limited domestic resources, such as local component suppliers and availability of specialized machinery.

Imports of these items are restricted by the nature of the country's foreign trade, particularly with the West, which is conducted on a strict bilateral basis with fixed quotas for specific commodities.

The industry has a relatively low priority for new investments, since



Completed chassis are conveyed onto a pair of stationary rails at the end of their assembly line as the drag chain with carriers doubles back under the floor. A limit switch releases the overhead pick-up fixture, which swings down to grip the central backbone, then conveys the chassis forward through the paint booth along the power-and-free monorail.

the Communist planners favor machine tools and other branches of heavy engineering. This means, for example, that not only is the old factory under-equipped, but that there is little flexibility to smooth a manufacturing changeover of this kind. Cost precludes optimum replacement or duplication of equipment at the new site.

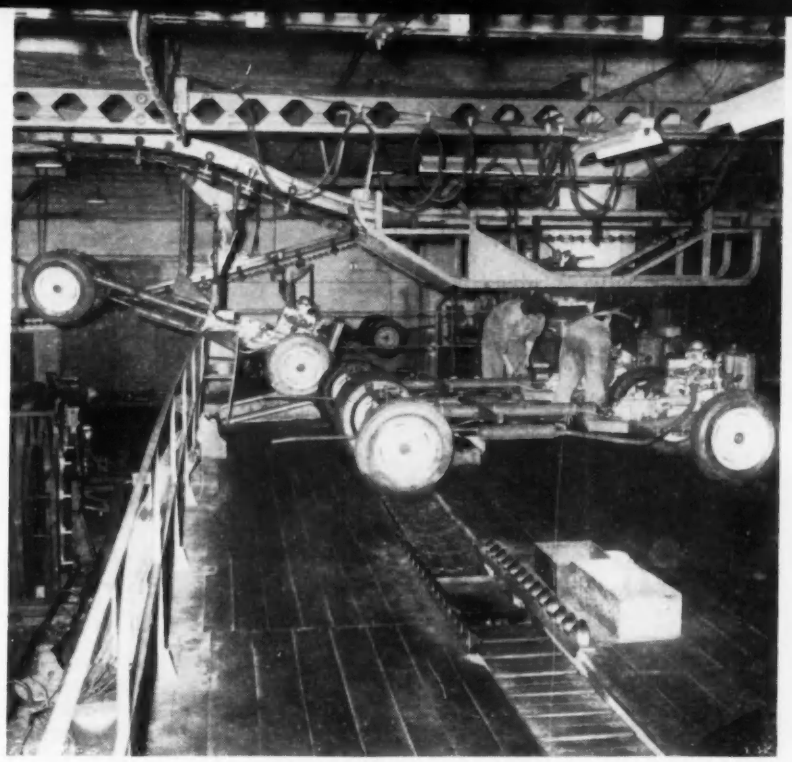
The present plant dates back to the turn of the century, and today is tooled with a medley of machinery running the gamut from the early inter-war years to the latest from western Europe. Piecemeal modernization started in 1957, and in the 1958-9 period considerable sums of hard currency were spent on equipment from the West, largest installations being a 28-station Hüller transfer line for gearbox housings and a Blasberg plating plant, both from Germany.

Since then the program has tapered off, although recent additions seen during the visit to the factory this autumn included a Schüler 8-station transfer press for hub caps, several welding and forging presses, and a scrap-baling press made by Skoda in Pilsen. Materials handling has also been improved, with monorails on several of the assembly lines, greater use of pallets in the press shop, and underfloor scrap conveyors beneath the press lines.

In the past year, too, the Skoda plant has had the burden of excessive self-sufficiency somewhat eased, being now able to buy out more parts from specialized producers in the country. Among these are complete brake assemblies, shock absorbers and front suspension members, which hitherto it had made itself.

However, the factory is still compelled to turn out an exceptionally high proportion of the required components, the list ranging from springs and hose clamps to gaskets and universal joints. As a result, production costs are high because runs are short, and capital and labor resources are spread thinly over a large number of items.

In addition, both production and detail appearance of the cars are affected by the limited availability



After wheels are mounted on the painted chassis, the monorail dips down at the start of the final assembly line where an automatic release mechanism disengages the supporting fixture. The chassis is deposited on the parallel tracks which convey it transversely to the body-drop station. Conical rollers (foreground) between adjacent conveyors are a dwell position to assist aligning the chassis under the body.

or variety of minor parts like fasteners, switches and plastic or nylon moldings. Special fasteners are one of the weak points. For example, the rubber sealing strips for door frames are attached by screws rather than by spring clips.

Some progress in job contracting has been made in the past year or two, and this is expected to increase as growth in car production justifies more specialized manufacture in outside plants. There are now six main auto component factories in Czechoslovakia, making electric equipment, instruments, carburetors, heaters, service tools and similar parts and accessories, as well as a number of smaller ones.

(*Turn to page* 103, *please*)

Final stretch of the assembly line, where cars are conveyed end-on until completion. Following the earlier body drop, they are turned through 90 degrees by gravity. As the incoming track at the upper level advances each car to the top of the wooden ramp, the right rear wheel is retained to pivot while the front wheels swing downward over a double quadrant of rollers.



Showing the Quality Picture...

The Histogram

Edward J. Diggs
Vinco Corporation

WHILE I was with Detroit Transmission our experience was that foremen, tool set-up and machine re-build people learned the use of histograms in short training sessions and religiously used them on every machine they checked. A metal box attached to every new machine in the plant contained copies of these HISTOGRAM checks so that past history on the machine performance was handy right on the production floor. Besides getting better set-ups than before, many more of these people have become quality concious through this program—and for the first time are now contributing members of the quality control program.

What is the HISTOGRAM? It takes three things to make one—paper, pencil, and data. It has two parts, lines or columns called cells and a frequency scale. I'm sure you'll agree it is simple enough—but what can it do? How is it used? Well . . .

It can tell where tools are set and how much to move them for correct settings

It can give us an average without doing any arithmetic

It can tell us if a machine is capable of doing its job correctly

It can show us how one machine compares with another; or how the different stations on one machine compare

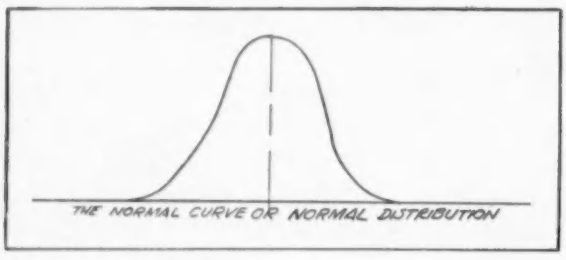
It can tell us the limits we are able to hold on a machining operation

In an investigation, it can tell us if we are barking up the wrong tree

It can be easily understood by shop people with a short explanation and some practice

And many other little services too numerous to mention

I shall show you how HISTOGRAMS can do these things a little later, but first let's have a brief lesson in some low-brow statistics to see how the HISTOGRAM originated and what statistical gimmicks it contains.



Just about everything in our world varies according to a normal pattern which statisticians call the "normal distribution." We can think of many examples from every day life. For example, the height of each gentleman here in the audience. Or the batting averages of baseball players, the count from rolling dice, the miles per gallon when we check our auto economy, the phone bills we receive each month. These would all be normal distributions under normal circumstances. In the shop we know that all machines produce parts which vary if we accurately measure them. These too vary in the normal pattern.

Now the normal distribution gives us a picture of this variation. The peak of the distribution is where we find the average—it is usually where the largest group of one number is found and we usually find about half of the remaining readings below this average and half above it.

This normal distribution is a fixed picture. Its size and shape are well defined. Permit me to get technical for a moment to show one way which this fixed picture is defined. We call the distance from one end of the distribution to the other the spread. If our picture showed the results of rolling a pair of honest dice—this spread would be from 2 to 12. Now from one end to the other, from 2 to 12, we measure in units called sigma (σ). There are always six sigma from one end to the other or three on either side of the average. Another name for sigma is a standard deviation. It may be interesting to know that if we mark off the normal distribution into six equal parts along the frequency scale (three on each side of the average) we know exactly what per cent of the total readings will fall into each group: 66% in the $\pm$ one sigma area, 95% in the $\pm$ two sigma area, and 99.97% in the $\pm$ three sigma area. This indicates that in a normal distribution all but about 3 out of 1000 readings will fall into the $\pm$ three sigma area.

This is then, a rather clearly defined picture. Now, the normal distribution only applies to an entire population of people, or an infinite number of dice

throws, or every baseball player in existance or every mileage check which could be made, or every phone bill you receive in a lifetime; and you can easily realize that time would prevent us from evaluating such entire populations, etc. So we take samples of the population and these samples will approximate the normal distribution but will seldom show the perfect curve. I have only seen one experimental situation which was a perfect curve when we plotted it. But, I have seen hundreds of curves which were close to perfect—and these are just as valuable in our work.

I mentioned that the middle or peak of the curve was the average. Well, there are different kinds of averages and in HISTOGRAMS—three are important to know. These are the mean, mode, and the median. The mean or arithmetic mean is the math average we are all familiar with. 2 + 6 + 4 + 3 + 4 +7 + 1 + 3 + 6 + 4 equals 40. 40 divided by 10 is 4. Therefore, 4 is the arithmetic mean or "mean" of this group of numbers. The mode is the number of greatest incidence. If we group the like numbers we find:

In this group we have a *mode* of four since there are 3 fours, more than any other number.

#1 — 1
#2 — 1
#3 — 2
#4 — 3
#5 — 0
#6 — 2
#7 — 1
10

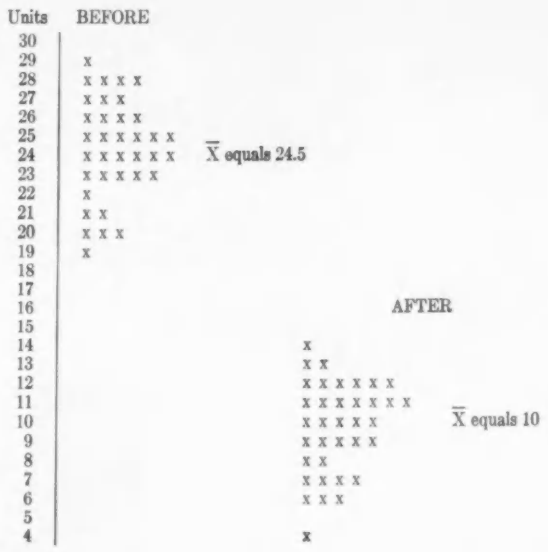
The median is the middle value of an array of numbers. Therefore, in the group above since there are ten numbers, the fifth or sixth is the middle value. Counting down from the top (or up from the bottom) the fifth and sixth numbers are both fours and so once again the answer is four.

By chance, this group of numbers had a mean, mode, and median all equal to four. This does not always happen and it is equally true that all three averages are not always important.

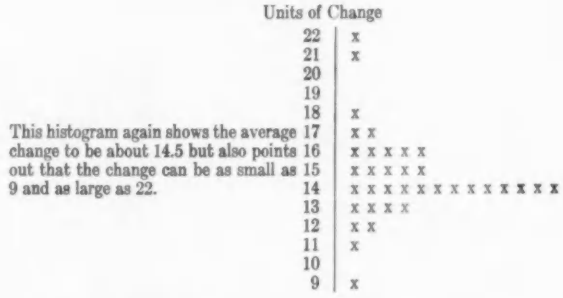
The HISTOGRAM is merely a picture of a sample of data from some population of data. Usually data is collected on a sheet of paper by listing it in the order it was collected. Notice the data below:

Piece #	Before	After	Net Change	Piece #	Before	After	Net Change
1.	23	12	11	19.	24	7	17
2.	27	11	16	20.	25	11	14
3.	23	8	15	21.	27	10	17
4.	25	10	15	22.	19	6	13
5.	21	7	14	23.	26	12	14
6.	27	9	18	24.	28	12	16
7.	25	11	14	25.	26	11	15
8.	22	8	14	26.	24	11	13
9.	25	13	12	27.	28	14	14
10.	24	9	15	28.	26	10	16
11.	24	12	12	29.	24	10	14
12.	24	10	14	30.	20	4	16
13.	26	11	15	31.	23	9	14
14.	28	7	21	32.	25	11	14
15.	23	9	14	33.	23	9	14
16.	20	7	13	34.	20	6	13
17.	28	6	22	35.	25	12	13
18.	29	13	16	36.	21	12	9

Using this data we construct the HISTOGRAMS of the before and after information:



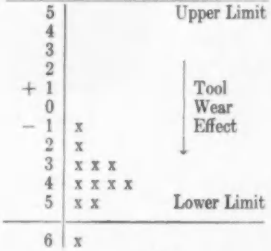
This HISTOGRAM method is quick and gives a good picture of the data. We could say that the data "before" was from a normal distribution and by taking the mode or median we can easily get the average of 24.5. The total spread is about 10 units, from 19 to 29. The "after" HISTOGRAM shows a normal picture, the average (by median method because the mode appears off center) is about 10 and the spread once again is 10 units, going from 4 to 14. Our conclusion would be that the change is an average of 14.5 (24.5 minus 10) and the total spread is unaffected. We could go a step further and make a HISTOGRAM of the amount of change:



This histogram again shows the average change to be about 14.5 but also points out that the change can be as small as 9 and as large as 22.

The main point I would stress is the advantage to be gained by converting raw data (such as the list of numbers) to the picture form of a HISTOGRAM.

I mentioned earlier that I would show how HISTOGRAMS perform many varied tasks. Let's go through some examples.



If this histogram showed the readings obtained from a group of 12 parts run after a tool was set, we would recommend changing that setting because we already got one part out of limits and will most likely get more if we continue to run this way.

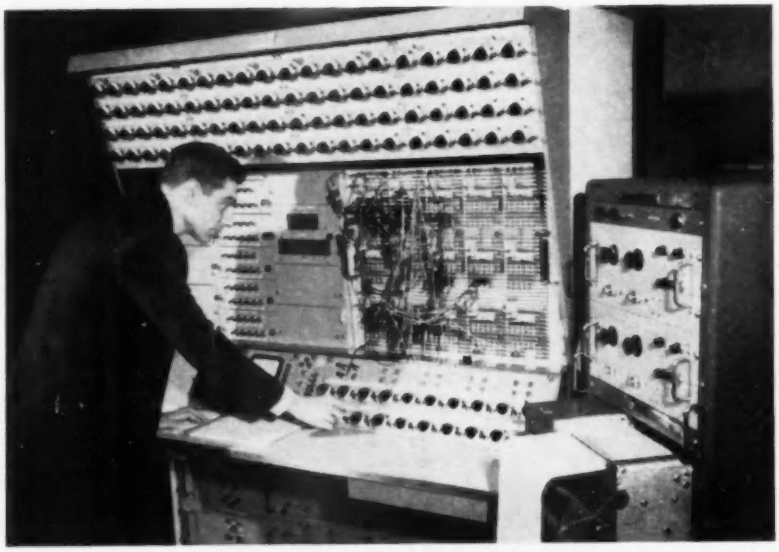
(*Turn to page* 128, *please*)

Digital Computer Utilization in the Design of an Experimental ARMY TRUCK

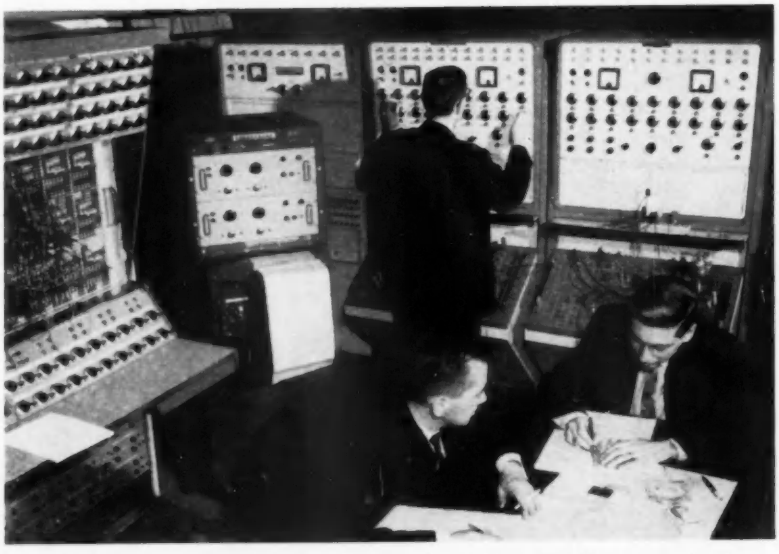
By

T. J. Bischoff and R. D. Arno

Ordnance Tank-Automotive Command
DETROIT ARSENAL
Center Line, Mich.



Close-up view of one of the computers in the OTAC laboratory (U.S. Army photo)



Computers used in designing the experimental truck (U.S. Army photo)

IN past years analysis of military vehicle performance and corresponding selection of proper axle gear ratios and engine-transmission characteristics for new military ground vehicles (both wheeled and tracked) was a laborious task involving many manhours of technical personnel, careful graph plotting etc.

Today at the Detroit Arsenal, everyday usage is made of our computer equipment in the evaluation and building of future vehicle designs. The Electrodata 204 Datatron digital computer, Flexowriter, and PACE dataplotter and associated equipment permit rapid evaluation of vehicle power train proposals at great savings in time and manpower. Programs have been prepared for both wheeled and tracked vehicles. These programs have been thoroughly correlated with actual field test results.

Detailed reports on these programs are available upon request for qualified facilities doing military work.

XM521 ANALYSIS

In the design and selection of gear ratios for this new XM521 advance design truck, the general computer program for performance of wheeled vehicles was used to provide data on acceleration, drawbar, gradeability, net tractive ef-

fort developed and required, range of operation in individual gear selections, etc.

After determination of the engine-transmission combination (an experimental air-cooled engine coupled with a modified commercial four-speed transmission), selection of the transfer case and axle design was undertaken. Of particular importance was a selection of high and low range gear ratios for the transfer case and a final axle gear ratio that would best provide compliance with long standing military performance requirements for tactical military trucks, i.e.:

a. Three per cent gradeability at 30 mph with rated cross-country payload and towed load.

b. Sixty per cent gradeability with rated cross-country payload.

c. Maximum speed of at least 50 mph.

Other operational requirements desired were:

a. Continual operation of a three per cent grade at 30 mph with rated cross-country payload and towed load without shifting of gears.

b. Operation in the above condition at maximum torque and fuel economy conditions.

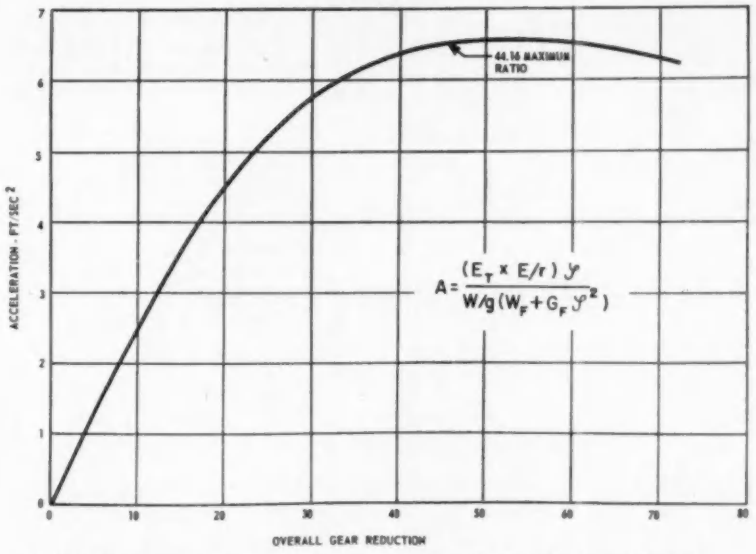
c. Continued operation on at least a 6 per cent grade without shifting gears.

d. Continual operation (in the particular gear selection) on the 3 per cent, 6 per cent and 60 per cent grades throughout the entire range of engine operating speeds without shifting of gears.

e. Maximum overall acceleration and agility for all gear ratios.

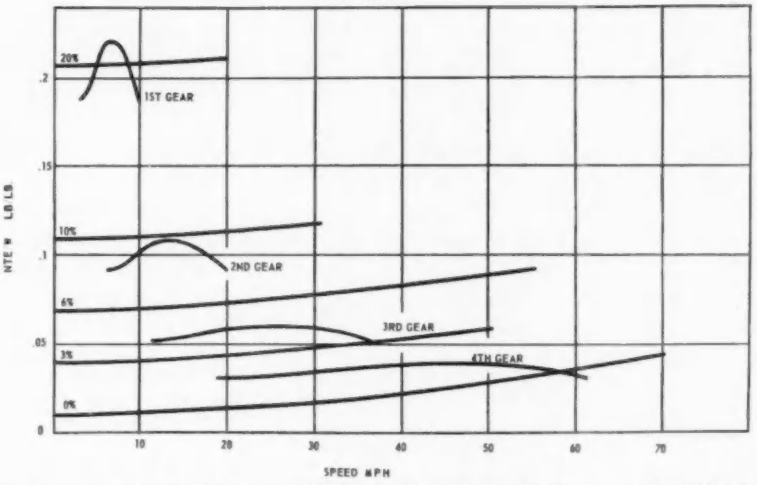
Several arbitrary axle ratios (including 5.40, 6.60, 6.90, and 7.20) were selected within the range of capability of the new double reduction Spicer axle design to be used. All of these items were "run on the computer"; and printouts were made with the Flexowriter showing velocity, time, distance, transmission rpm, engine rpm, output torque at wheels, tractive effort, drawbar pull, gear ratio, acceleration, and gradeability. Also the curves were plotted automatically

FIG. 1



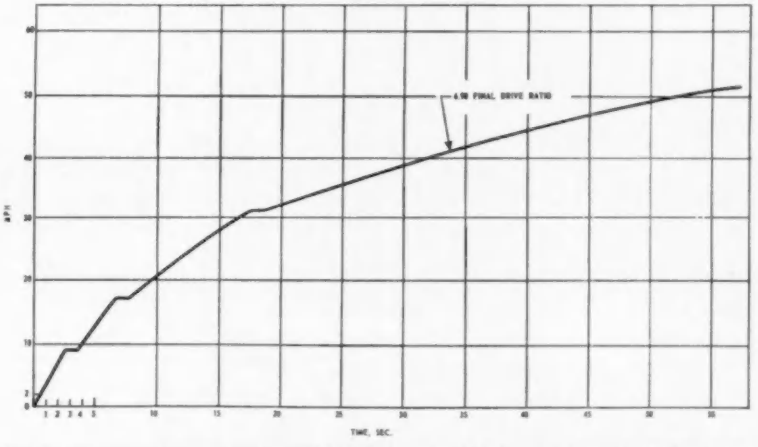
XM relationship—gear reduction vs acceleration (U.S. Army photo)

FIG. 2

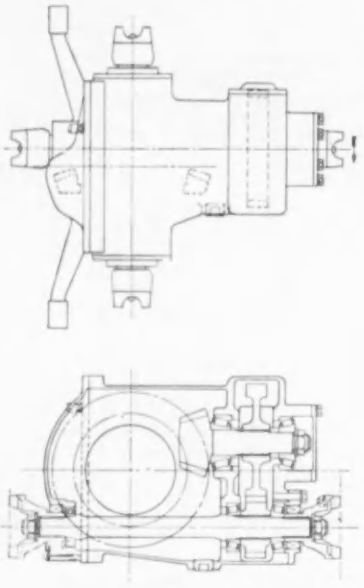


Net tractive effort/vehicle weight developed and required vs speed. XM 521, 2½-ton truck, high range W/5000 lb, towed load. Rear axle ratio 6.90. (U.S. Army photo)

FIG. 3



Acceleration performance for XM 521 truck, 2½-ton swimmer, high range (U.S. Army photo)



XM 521 axle assembly (U.S. Army photo)

with the PACE dataplotter in various forms such as mph vs. time, NTE/W vs. speed, and DBP vs. speed with gradeabilities. This information provided a basis upon which to make an evaluation of the various gear ratios and to judge which one would provide the optimum combination of characteristics.

The final ratio selected was 6.90:1; this results in very desirable characteristics as follows:

a. Operation on a 3 per cent grade at 30 mph with rated gross combination weight as required. Also obtainable was continual operation on this grade throughout the engine speed range without shifting gears, and operation at near maximum torque and fuel economy conditions at 30 mph.

b. Operation on an 8 per cent grade in 2nd gear over whole engine range.

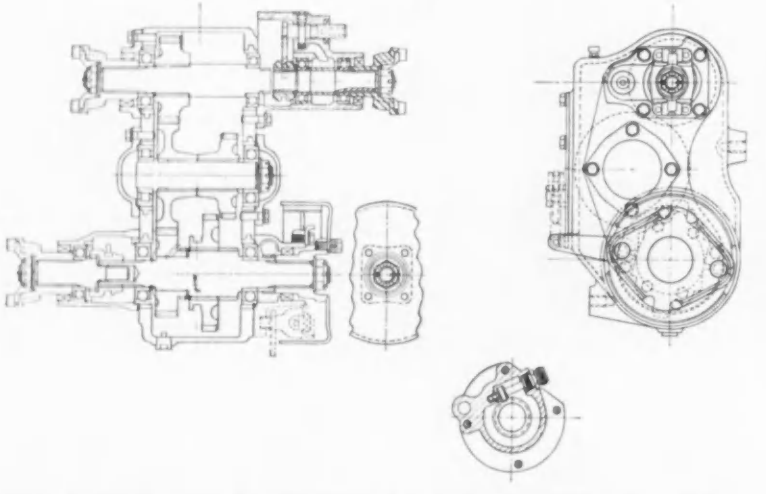
c. Gradeability of 60 per cent in low range, 1st gear, over whole span of engine speed.

d. Maximum highway speed of 58 mph.

The 6.90:1 ratio also provided near peak acceleration capability for the power plant provided. Acceleration curve for the vehicle is shown in Figure 3. Another curve (Fig. 1) shows the relationship between maximum acceleration and overall gear ratio of the power train. This curve was derived from the acceleration equation:

$$A = \frac{(E_T \times E/r)\,\varphi}{W/g\,(W_F + G_F\,\varphi\,2)}$$

This equation was differentiated with respect to φ and set equal to 0, and the resulting algebraic equation when solved for φ will give the overall reduction ratio of 51:1 needed for maximum acceleration. Actual overall ratio used was 44.16 in view of other factors desired. It should be noted that (in Figure 11) most curves of this type fall off more rapidly after reaching the peak ratio.



XM 521 transfer case assembly (U.S. Army photo)

CONCLUSION

Usage of the digital computer program has been very effective here at OTAC in providing very rapid calculation of all possible conditions with several different power train combinations at tremendous savings in engineering talent and cost. This method of matching the XM521 performance as near as possible to the exact military requirements contributes substantially to the low vehicle curb weight, good performance, and economy of operation.

TEST PROGRAM INPUT DATA

Problem solution and data printout require the use of 10 subroutines. Subroutine numbers and descriptions are listed in the same order as they appear on the program printout but subroutines are not shown because of space limitations.

410	Dataplotter routine
007	Automatic high-speed tape feed
400	Data printout
401	Linear interpolation
099	Error routine
204	Cosine θ
203	Sine θ
206	Arctan θ
002	Alphanumeric printout
FPA.	Floating point arithmetic

Compiler code, description and storage locations for program variables and constants are as follows (these compiler codes are shown in the flow chart of Figure 2):

Compiler Notation	Storage Location	Description
$^{1}1$	0001	Variables 40–59 subscript for grades in % slope
$^{1}2$	0002	Variables 60–70 subscript for shift rpm
$^{1}3$	0003	Variables 80–89 subscript for transmission ratios
$^{1}4$	0004	Variables 90–99 subscript for standard transmission efficiencies
$^{1}5$	0005	Constant, one less than the number of gears for standard transmission only
$^{1}6$	0006	Variables 150–249 subscript for Dataplotter velocity

(*Turn to page* 135, *please*)

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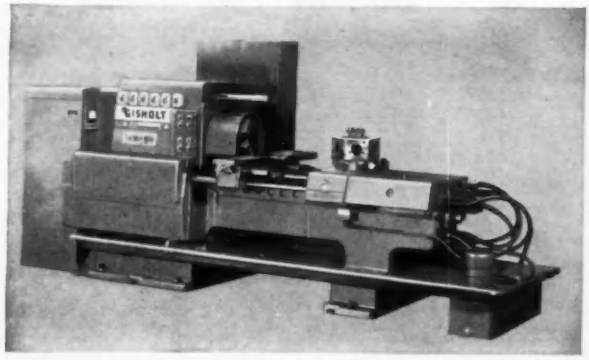
Lower costs, less dependence on operator skill, faster production on a wide variety of jobs—these are just a few of the many benefits offered by the Gisholt family of automatic lathes.

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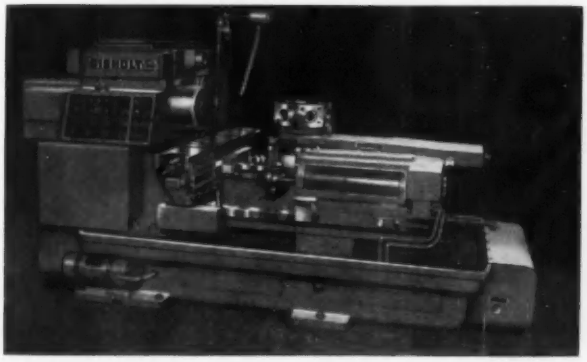
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Circle 138 on Inquiry Card for more data

Selecting Proper Cutting Fluids

By
Joseph Geschelin
DETROIT EDITOR

MANUFACTURING economy, as well as the quality of surface finish and maintenance of desired dimensional tolerances, depends upon many variables. These variables are well known and do not need repetition here. Aside from the variable factors we are faced, for any given chip producing operation—with the machine, the cutting tool, and cutting fluid. These three major items are interdependent. It is my intention to touch on the cutting fluid alone, mainly because it is the key to successful chip production.

Although cutting fluids are being consumed in industry in enormous quantities—measured in millions of gallons in the automotive industries alone — little tangible work has been done to remove the veil of mysticism and give the user some real handbook information as to their selection and utilization.

Large industrial organizations such as Ford, General Motors, and Chrysler, have recognized the importance of the problem and are approaching it in different ways in search of a practical solution. These organizations have vast facilities as well as trained personnel, particularly in the field of chemistry and metallurgy. But what about the smaller producers who have neither the facilities nor the specialized manpower?

The writer has studied the setup at Ford, GM, and Chrysler. Their problems are so special—aimed first at extremely large numbers, and colored by an extensive use of centralized coolant systems that the several solutions do not seem to have general application in smaller plants.

The Problem

This takes us to the heart of the present situation. Millions of tons of metals are being machined and thousands of tons of chips and scrap are being produced in the process. Since manufacturing economy is paramount, and since the efficient application of cutting fluids contributes so largely to overall economy, it is obvious that once and for all steps must be taken to show the users of cutting fluids how to select the proper materials out of the many varieties being marketed today; and how to use these materials most effectively.

One of the best and most direct approaches to this problem is to provide an up-to-date recommendation chart, based upon current practice in the metal-working industries. That is to say, the raw material would come from a nation-wide survey of usage but the final chart would represent the best compromises of data consistent with the experience of a group of specialists assembled to review and digest the data.

The function of this chart would be to serve as a guide, a starting point for specific applications. In essence, the user, no matter how small or large, then would have the benefit of the experience of many users as a starting point. This would enable him to make modifications to suit the requirements of a given setup. At present there is no such starting point available.

Pool the Data

Most of us will agree that this is not a startlingly new proposal. Most cutting fluids suppliers have recommendation charts of their own, at least for the benefit of field engineers. The proposal here is to pool the resources of the entire group and come up with a single recommendation that would represent the experience of the entire group, based upon a nation-wide survey of practice.

Both Ford Motor Co. and Chrysler Corp. have developed standard procedures at their respective central offices for use as a guide by all plants within their jurisdiction. These ground rules are made deliberately flexible to enable the management of a specific plant to select materials more readily available in their area; also to make modifications more suitable to their equipment and operating conditions.

For those of you who may not be familiar with the Independent Research Committee on Cutting Fluids, let me say quickly that this group was formed by the writer before WWII. It operated during the war and for many good reasons was absorbed by ASTM some time after the end of the war. In any event, IRC was designed specifically for the practical operating level, aiming at direct benefits to the users of cutting fluids. About 1940 IRC conducted a nation-wide survey of practice with the aid of the field force of the many refiner representatives on the committee. The recommendation chart arising from this study was given wide circulation at the time. It was presented before a number of engineering societies; it was incorporated in the ASM Handbook of that day; it was used in handbooks issued by a number of trade associations.

A Practical Table

A necessary adjunct to a recommendation table for cutting fluids applications is a practical machinability table. Here again we find that most metal producers have tables of their own. A great deal of practical data are readily available. What needs to be done, and what we did at IRC, is to have a competent committee group take all of the available data and digest it into a single machinability table representing the best compromise

(*Turn to page* 112, *please*)

Circle 139 on Inquiry Card for more data ⟶

What HORACE DREVER has to say about Lindberg heat treating equipment



Mr. Horace Drever, internationally prominent in the industrial heating field, is a Past-President of the Furnace Manufacturers Association and President of Drever Company, furnace manufacturers and commercial heat treaters.

QUOTE from Mr. Drever's unsolicited letter to Lindberg Engineering Company

"For the past three and one-half years, we have been operating one of your Type 243618 GVRT Furnaces along with a 500 CFH Lindberg Hyen generator in our commercial heat treating division. We are extremely pleased, not only with the fine quality of work turned out by this equipment but also its relatively trouble-free operation. As evidence of our complete satisfaction we have ordered another Lindberg Furnace of this type."

DREVER COMPANY



Lindberg Furnaces in operation at the Drever Company, Bethayres, Pennsylvania.

We are happy that Mr. Drever, a furnace manufacturer in his own right, originally chose Lindberg equipment for his heat treating plant and that its satisfactory service prompted an additional order. The second Lindberg Furnace is now in production at Drever Company, as the adjacent photo shows. Bless those satisfied customers! If you have a product or process in the metal or ceramic field requiring the application of heat you can depend on Lindberg's engineering and design know-how to provide exactly the right equipment to answer your need. Get in touch with your nearest Lindberg Field Representative (see classified phone book) or write direct to Lindberg Engineering Company, 2491 West Hubbard Street, Chicago 12, Illinois. Los Angeles plant: 11937 South Regentview Avenue, Downey, California. In Canada: Birlefco-Lindberg, Ltd., Toronto.

LINDBERG
heat for industry

Ignition Problems and Combustion Chamber Phenomena Discussed at the

By Joseph Geschelin
DETROIT EDITOR

Second Ignition Performance Conference

Now that all passenger car manufacturers are committed to a 12-month warranty period, the service problems in the field assume a new dimension for factory management and engineering, as well as to the service organization. An important contribution along this line stems from the proceedings of the Second Ignition Performance Conference sponsored by the Champion Spark Plug Co. It was held in Toledo October 4-6. What started last year on a modest scale drew an attendance of well over 100 people, including service representatives and engineers.

Many Manufacturers Attend

Apart from petroleum refiners and marketers, the following manufacturers were well represented at this event: International Harvester Co., Outboard Motor Corp., McCulloch, Mack Trucks, Kiekhaefer Corp., American Motors Corp., Studebaker-Packard, P-D-V Division of Chrysler Corp., Clinton Motors, Ford Motor Co., and Ford of Canada.

The meeting was wide open to frank discussion, many of the more revealing statements being made "off the record." Many of the problems associated with ignition and combustion chamber phenomena were covered in detail. Among these were the ever-present phenomena of spark plug fouling, preignition, misfiring, and cross firing.

Considerable attention was given to fuels and lubricants: the effect of scavengers in the fuel, the effect of metal additions on lubricants, as well as the relative advantages of ashless lubes, the role of phosphorus in fuels, etc.

Blended Fuels

Out of the exchange of views on TEL (tetra-ethyl-lead) compound which is commonly used, and the more recent introduction of TML (tetra-methyl-lead) it was learned that TML does not pose a revolutionary change or improvement in fuels. According to petroleum experts, TML does not change the behavior of fuels, does not offer any significant advantages over TEL so far as the consumer is concerned. In fact, the principal role of TML is for the benefit of the refiner, aiding him in optimizing blend economics with base stocks that blend better with TML than with TEL additions.

Engine builders were assured that fuels blended with TML would not affect either engine operation or combustion phenomena. Consequently, no special attention has to be given to the type of fuel marketed in a given area.

It is obvious that for each engine there is an optimum location for the spark plug as well as the location of the gap within the combustion chamber. These items, together with the selection of a plug having the proper heat range, are among the primary objectives when the engineering department begins to finalize details. This is the point at which the spark plug producer is given an opportunity of cooperating in the selection of plugs of proper design. Champion found considerable success in the utilization of its extended nose type plug on OEM applications.

Special Thermocouple Spark Plugs

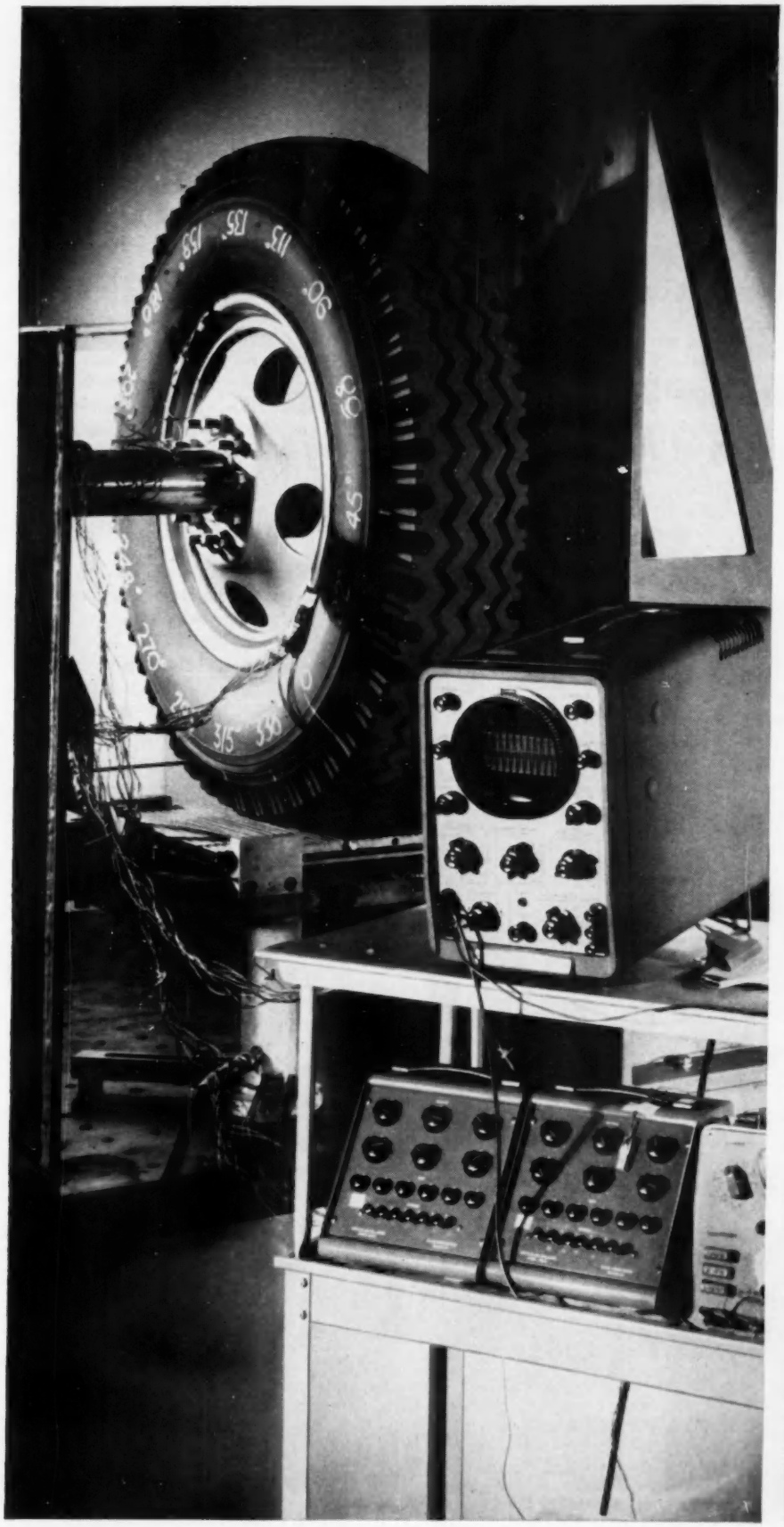
To aid in engine research at the engine builders level as well as in the field and in other laboratories, Champion makes available a specially designed thermocouple spark plug which gives accurate temperature readings at the nose of the plug. Such readings are invaluable in selecting plugs of proper heat range. Too, Champion research people have found this method much more reliable and more useful than temperature measurements at the spark plug gasket area.

Needless to say, there are many causes for spark plug fouling. However, it has become more difficult to judge the effect of fouling with the incidence of fuels containing phosphors. While phosphor deposits on the electrodes have the appearance of bad fouling, the fact is that if the deposit is mainly phosphorus the plug will continue to fire adequately. Many plugs discarded in recent years could have been reused if the nature of the deposit had been recognized. Oil companies intend to put on an educational campaign among their outlets on this point.

Conversions to LPG invariably result in cleaner engines as well as a major reduction in plug foulings. One operation was cited in which the plugs remained in service for 28,000 miles in a large coach operation.

Ignition Cross Fire

Of interest to engine designers was the discussion of the phenomena of cross fire. This is associated with the disposition of ignition wires in the harness and in the manner of arrangement at the plugs. If it is necessary to run wires parallel to one another for any distance, care must be taken to prevent contact. This is best done by staggering the wires so that adjacent firing cylinders of a V-8 do not have the wires close together or touching. One effect of cross fire is preignition. ■



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K H

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News of the MACHINERY INDUSTRIES

NMTBA President Predicts Rise in Machine Tool Sales Coming from the Realization of U. S. Industry that Production Equipment Must Be Modernized to Meet Competition

By Charles A. Weinert

Machine Tool Builders View Business Outlook at Annual Meeting of Association

The 59th Annual Meeting of the National Machine Tool Builders' Association met on a platform of general optimism. Most of its members felt The Machine Tool Exposition (Chicago, Sept. 6-16) had been a complete success. Many of the builders look for an up-trend in business coming as a result of the mass display of more-productive machines at the Exposition—and, mainly, because of the need of industry to meet competition by cutting production costs.

Held at Hot Springs, Va., on Nov. 2-4, the meeting had an attendance of about 350 executives. Government officials, as well as machine tool distributors, also participated. Guest speakers from Government discussed various aspects of machine tool exports and imports, together with European trade with the U. S. S. R.

President's Report

Alan C. Mattison, 1959-60 president of NMTBA and president of Mattison Machine Works, reported his views on the current situation in and outlook for the machine tool industry. As he expressed it, the report was "a general perspective" gained from contacts during his tenure the past year as president of the Association.

Mr. Mattison's report was both energetic and optimistic. He feels there is no place for pessimism at this time, despite talks of a "recession" and even though orders were on the low side in September—when, as he pointed out, the builders were exhibiting and users were studying the newest equipment.



EVERETT M. HICKS
President-Elect of NMTBA

The speaker said that based on the reports he had had from exhibiting companies, the 4th Quarter of this year should be the best quarter, from the standpoint of new order volume, that the machine tool industry has enjoyed for a long time. He added "it is my firm belief" the effects of the Exposition "will be felt through 1961 and well into the next two years."

Mr. Mattison commented on the so-called "recession." He declared, "The economists and business commentators are having a hard time, these days, deciding whether the country has been in a recession and didn't know it; or whether we are in a recession right now; or whether we are headed for a recession in 1961."

He attributed a lot of this talk to pre-election jitters, and expressed the opinion that "the ex-

(*Turn to page* 85, *please*)



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Director

NEW PRODUCTION and PLANT EQUIPMENT

By C. J. Kelly
ASSISTANT EDITOR

FOR ADDITIONAL INFORMATION, please use reply card at back of issue

Welding Power Supply

THE development of a medium range electronic welding power supply with a range selector switch for finer control at low settings and an automatic lockout to prevent premature discharging has been announced.

The new power supply is designated the VTW-32, Its range selector switch allows either a one to 25 watt-second or a 10 to 250 watt-second range. The one to 25 watt-second range provides an expanded meter scale, and increases the stability of energy stored at low ranges. Switching from one range to the other automatically discharges any stored energy, changes the meter calibration and allows the power supply to charge to the new setting.

Up to 7200 welds an hour can be made, with exact repeatability of weld energy which is released in only 0.002 of a second, providing a tremendous energy burst, to create weld heat even in difficult metal combinations.

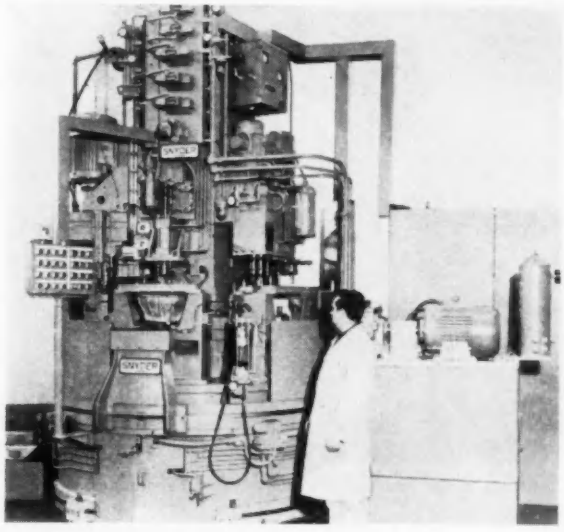
The VTW-32 is packaged in two vertical cabinets. The main cabinet contains all controls, the weld transformer and all of the electrical components. The second cabinet contains only the oil filled capacitors and is connected to the main cabinet by a five ft cable. *Hughes Aircraft Co.*

Circle 35 on postcard for more data

Special Five Station Center Column Machine

THIS five station machine, which the manufacturer reports drills, reams, bores and taps aluminum automotive engine flywheel cover housings at a rate of 163 pieces per hour, at 100 pct efficiency, features standardized base, machining units and drill heads. The base of the machine has circular T-slots at the top and bottom which permit wing-base units to be spaced around the column at any desired position. Conventional center column machine bases have machined faces to which wing bases are keyed and bolted. This new base design provides maximum flexibility in the future placement of units. Both slide and leadscrew tapping units that mount on the column, as well as the heads that mount on these units, are standardized designs that utilize standard drawings and unit assemblies that cut design time and avoid repetitious pattern drawings and pattern-making. *Snyder Corp.*

Circle 36 on postcard for more data



This is the first in a new line of standardized designs for center-column type machine tools. The five stations employed on this unit can be set up to do a wide variety of drilling, boring and tapping operations. One of the main features is the large quantity of work that can be processed per hour. The standardized base and machining units were chosen to provide maximum machining flexibility.

Precision Turret Lathe

A NEW turret lathe called the number 2 Micro-Cut has been introduced.

Specifically designed to handle the most critical machining requirements of medium to small size precision parts, the new lathe, according to the company, is especially suited to instrument work, and many "space age" machining jobs involving miniature electronic, hydraulic and computer components.

An important feature of the Lathe is that it retains overall ruggedness and universal characteristics of a turret lathe, and adds the superior accuracy capabilities of a precision instrument lathe. On production runs of work pieces that can be chucked only once—because of delicate configuration and critical concentricity limits—yet still demand substantial metal removal and super accuracy, the new No. 2 Micro-Cut meets all requirements, the manufacturer reports.

The machine swings 14 in. over the bed and 6 in. over the cross slide. The spindle is a 5 in. American standard flanged nose type A-1.

Constructionwise, the new lathe exhibits some interesting design concepts. The head contains only the spindle, which is mounted in sealed-for-life ball bearings. Usual headstock gearing, clutches, bearings, etc., are located in the base of the machine. Eliminating these components from the headstock reduces heat and thus minimizes spindle rise. Better finishes also are obtained with no gears connected to the spindle. In addition, factory installation and sealing of the bearings for life is said to eliminate field adjustment problems.

The front bearing mount consists of two angular-contact ball bearings mounted back-to-back and preloaded against each other. This layout reportedly eliminates practically all end-play and rotary eccentricity. The rear mounting is a single, angular-contact ball bearing preloaded against a spring. This design prevents variation in motor belt tension from affecting spindle "lay."

Circle 37 on postcard for more data

Indexing Table

THE "Milichex" rotary indexing table model M2X-900 for fractions of angles features a double-table arrangement which allows setting angles to ¼-deg with an accuracy of ¼ second of arc. Useful for either inspection or machining, this rotary indexing table eliminates gage blocks and permits operator to quickly set and reproduce any angle in increments of 15 min.

Extreme accuracy and simple operation are claimed for the Milichex due to double-table construction. Lower table is a standard Milichex



model MX-3600 360-tooth rotary table indexing in full degrees. Upper table is a special 96-tooth rotary table with each tooth equal to 3 deg 45 min. Any angle in increments of 15 min is reproduceable by adding or subtracting one of several multiples of 3 deg 45 min, on the upper table, to the full degree setting of the lower table. For example, to set 23 deg 45 min, the lower table is indexed to 20 and the upper table to letter D corresponding 3 deg 45 min. Only four letter indexes A (—3 deg 45 min), B (—7 deg 30 min), C (0), D (3 deg 45 min) are required on the upper table to duplicate any angle to 15 min increments.

Table top of this unit is 12 in. in diam and parallel with base within 0.000050 in. Top is furnished with large number of drilled and tapped, radially dispersed holes for easy attachment of workpieces or fixtures. *Michigan Tool Co.*

Circle 39 on postcard for more data

Gear Hardening Fixture

A NEW air-operated fixture recently constructed by Induction Heating is able to harden any pinion or gear up to 20 in. in diam and with a maximum face of six in. The fixture is completely automatic except for feed and take-off, and heating time averages 10 seconds per tooth. No extra time is required for quenching since it has been made part of the indexing cycle and immediately follows the heated tooth.

To set up the work, the operator first selects the proper interchangeable water-cooled work coil. With the correct adapters in place, the work is set into the lower bearing, then the upper bearing clamp is closed. The pressing of the "start" button begins an automatically timed cycle originally set up depending on the required number of teeth to be hardened. An air cylinder then indexes the entire fixture with the work in place into the heating zone.

Following the timed heat cycle, the cylinder reacts and a ground-insulated pawl selects the next tooth for heating. The pinion rotates one tooth and re-enters the heat zone. Meanwhile, the previously heated tooth enters the quenching area. Each time the air cylinder retracts, the action trips the limit switch which resets the timer for a new heat-quench cycle for each tooth. In turn, this action reverses the air cylinder stroke. *Induction Heating Corp.*

Circle 38 on postcard for more data

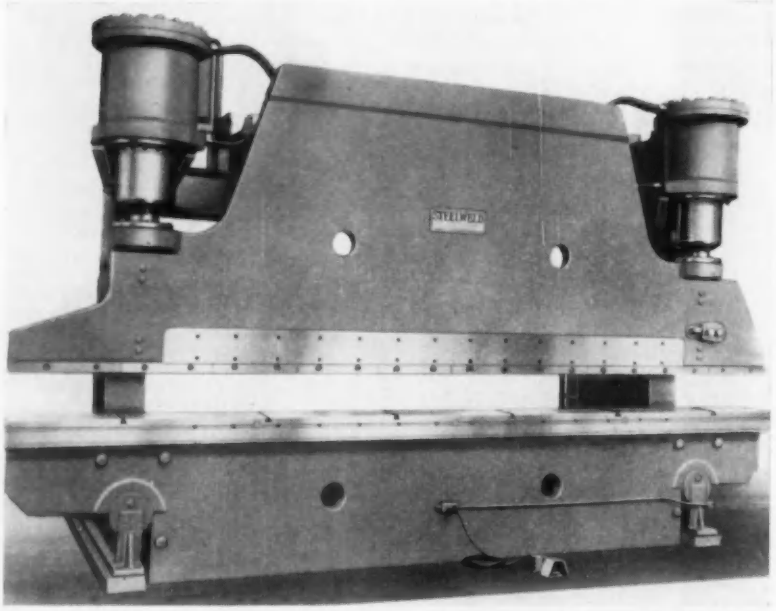
Hydraulic Press Brake With Deep Bed Design

A LARGE Steelweld hydraulic press brake with a deep bed extending 36 in. below the floor to assure minimum deflection is rated at 650 tons at mid-stroke and has an overall bed length of 20 ft 3 in. Distance between housings is 14 ft 4 in. A 15 in. bed and ram extension is provided at the left end.

The ram is powered by two hydraulic cylinders and can be started, stopped or reversed at any point in the stroke. This enables inching the ram to the work and backing it away wherever desired.

The machine has a stroke of 16 in., which is advantageous for deep bending and drawing work or where high dies must be accommodated. The power is constant for the entire stroke. The stroke may be adjusted to any length and between any points within the limits of the machine. This makes it possible to set the stroke length to exactly suit any particular operation.

This press has three operating speeds. Ram approach and return speed is 90 ipm, half-tonnage pressing speed is 45 ipm and full-tonnage pressing speed is 22 ipm. By simply turning a knob, the tonnage, or operating pressure, may be changed to suit the work. This limits the pressure to that desired. *The Cleveland Crane and Engineering Co.*



An outstanding advantage is the fact that the press cannot be overloaded.

Circle 40 on postcard for more data

News of the MACHINERY INDUSTRIES

(*Continued from page* 82)

tremely high level of goods and services produced" did not represent a recession climate. But he did add that while American industry has been "doing a tremendous volume of business," there hasn't been a sufficient margin of profit. This, in turn, was definitely due, he stated, to the rise in manufacturing costs and concurrent competition.

Mr. Mattison said, "We know that sooner or later industry in our country will come to the stark realization that costs must be cut in order to meet domestic as well as foreign competition. And we machine tool builders have what it takes to fulfill that need."

He further said, "We in the machine tool industry talk about the threat of foreign competition. But it is even a greater potential threat to many of the industries that are customers of ours. And the threat of foreign competition may well spur them into modernization programs. So one of the factors that we are worrying about may, by its impact upon our customers, bring us more business."

Mr. Mattison concluded his comments on this phase by saying, "I think that the genuine interest exhibited by visitors at the Exposition indicates that the metalworking companies of the United States are awakening to the situation right now. If that is the case, it will mean that the turn has come in machine tools; and that we can look forward for some time to a continuing rise in business. The potential is measured by the fact that over 62 per cent of the machine tools on plant floors of the U. S. are over 10 years old."

Exposition

Incidentally, the Exposition, according to Mr. Mattison, had exhibits by 119 machine tool companies. Attendance consisted of some 60,000 visitors "composed for the most part of exactly the right type of people we wanted there"—made up of engineers, production experts, factory managers, product designers, financial men, and other people directly concerned with production costs.

Training Manual

Mr. Mattison further reported that NMTBA's Training Committee, after five years of work, has completed a new machine tool training manual "based upon an entirely new concept." He said this manual will be the source of substantial cost savings to both users and builders of machine tools when training employes. It is scheduled for printing at Association headquarters within the next few months, following which it will be distributed to NMTBA members.

New Officers

During the Annual Meeting, the following were elected to office for the Association year 1960-61: **President**—Everett M. Hicks, vice-president and general manager, Machine Tool Div., Norton Co.; **First Vice-President**—Francis J. Trecker, president, Kearney & Trecker Corp.; **Second Vice-President** — Wallace E. Carroll, President, American Gage & Machine Co.; and **Treasurer**—Lawrence C. Gleason, president and general manager, Gleason Works. Grayson M. Stickell, president and general manager of Landis Machine Co., was re-elected **Secretary.**

New **Directors** elected were Mr. Carroll, Mr. Gleason, and Bruce F. Olson, president, Sundstrand Corp. Directors continuing in office are James K. Fulks, executive vice-president, Ex-Cell-O Corp.; Howard A. Gay, vice-president and manager, Machine Tool Div., The Cincinnati Milling Machine Co.; and John F. Herkenhoff, president and general manager, The Minster Machine Co.

Ludlow King was re-elected **Executive Vice-President** of the Association.

Around the Industry

National Broach & Machine Co.—has formed an associate company at Coventry, England, to manufacture, sell and service abroad its Red Ring gear shaving, honing and inspection machines, as well as precision ball leadscrews and Briney boring heads. The new company, named Precision Gear Machines & Tools Ltd., has a two-year-old, 76,000-sq-ft manufacturing facility purchased by National Broach from Birfield Tools Ltd.

Warner & Swasey Co.—Walter K. Bailey, president, stated at a recent N. Y. meeting that his company had booked more new orders for machine tools in September than in the previous 4½ months, tripling its order backlog. The influx of orders, he noted, was triggered by the Machine Tool Exposition.

Buhr Machine Tool Co.—Henry C. Daum, former manager in the Manufacturing Engineering Office, Manufacturing Staff, Ford Motor Co., has been appointed Buhr vice-president in charge of sales.

Norton Co.—Irvine F. Williamson has been appointed superintendent of the company's Santa Clara, Calif. plant.

Sheldon Machine Co.—Howard B. Carroll, Jr., has been elected president and general manager.

Ex-Cell-O Corp. — Fred T. L. Grimm has been named director of purchases. He succeeds Fred Sicklesteel, who retired in September.

Solid Carbide Tool Institute — Stewart W. Pollock of the Raymac Div., Dexco Corp., Detroit, is the Institute's new president for the coming year.

Sheffield Corp. — Oscar Ahlers has been named vice-president and general manager, following the resignation of C. Thorpe Thompson. Roy Heldenbrand is new vice-president of operations, being transferred from his position as president and general manager of the Threadwell Tap & Die Co. Louis Polk, Jr., prior vice-president of operations, resigned effective November 1 to accept an executive position with the General Mills Corp. ■

MODERN STEELS

for Lighter Automobiles

(*Continued from page* 67)

motive structures, there are maximum-deflection restrictions as well as load-bearing requirements. To get the same deflections with high strength steel means we must distribute it in a somewhat different way than we do with carbon steel.

For equal deflection, the moment of inertia of a structural section made from high strength steel must be the same as in the plain-carbon steel design. We can satisfy this by deepening the member somewhat, or by forming it to get proportionately more of the high strength steel in the flanges of the beam. This will generally result in somewhat more area of material being used in the design for the high strength steel. And this, of course, will give us smaller cost savings than we get with those structural designs where deflection is not a limiting factor.

Table D is a comparison of shapes formed from cold-rolled carbon steel sheets and from high-strength steel, similar to the comparison of the hot-rolled product.

For the four high-strength low-alloy steels (USS COR-TEN, TRI-TEN, MAN-TEN, and EX-TEN), the relative thickness reductions, weight savings and cost savings are about the same as for the hot-rolled product.

With optimum design we should get a weight saving of about 45 per cent over carbon steel, and cost savings of about 30 per cent.

As an illustration, structural analyses were recently made on several automobile underframes of hot-rolled carbon steel. These frames weighed from 360 to 400 lb. The steel cost about $20 to $23 per frame. Cross sections of the original carbon steel frame, and those redesigned in thinner high strength steel, are shown in the next three figures.

The thickness of steel used for the central frame member was reduced from 0.119 in. to 0.100 in. with the high strength steel (Fig. 5). To achieve the same deflection as with the carbon steel member, the depths of the section were increased from 5.0 in. to 5.4 in. The weight of the member was reduced from 79.8 lb to 67.8 lb—a reduction of a little more than 15 per cent.

In the rear frame side member, Fig. 6, the thickness of steel was reduced from 0.093 in. on the left and 0.119 in. on the right, to 0.080 in. and 0.098 in. The problem of deflection was overcome by putting extra metal in the overlapped areas of the top and bottom surfaces. In this instance the weight was reduced from 80.2 lb to 67.0 lb—about 16 per cent reduction.

The thickness of steel in the rear cross bar, shown in Fig. 7, was reduced from 0.119 in. to 0.080 in. It was not necessary to increase the depth of the section over the original 2.82 in. to maintain the deflection because the width of the section was increased from 1.200 in. in carbon steel to 1.610 in. in high strength steel. This new section weighs 6.1 lb compared to 7.8 lb for the carbon steel—a reduction of about 22 per cent.

Complete redesign of the frame, including members other than these three, resulted in a 23 per cent reduction in weight and a reduction in material cost of about 10 per cent by use of the high-strength steels.

The increase in depth of the central frame member from 5.0 inches to 5.4 inches (Fig. 5) in order to maintain deflection could probably be overcome by increasing the amount of overlapping metal on top and bottom, but even by leaving this member in carbon steel, the reduction in weight of the entire frame would be about 20 per cent with a reduction in cost of material of almost 10 per cent.

The same thing should be possible with the new unit-body frame in which the body, rather than the underframe, supplies most of the rigidity of the whole car. Typically, the frame supplies only 27 per cent of the torsional rigidity and 34 per cent of the bending rigidity. Thus, even in body-frame construction, the body does the real work, and we need little change in strength in the structures above the floor pan to have the strength needed for unitized construction. However, weight reductions in the body, particularly above the belt line in such parts as pillars, roof rails, headers and roof bows, are very desirable to achieve the much wanted low center of gravity.

Also, generally the contribution of the roof structure in resisting bending and torsional forces becomes more important as the wheelbase of the car gets shorter. Doesn't this point to the need for higher strength steels? Herein lies incentive for critical reappraisal of materials and design, for future compact cars as well as for conventional-size cars.

In the unitized construction, the underbody strength members could be redesigned advantageously to use modern high-strength steels, bring about considerable weight savings, and probably some cost savings. Low-carbon steel sheets with yield points of about 25,000 psi, could be replaced with 45,000 or 50,000 psi high-strength low-alloy steel sheets in side rails, torque boxes, cross members, and front and rear horns, with a weight reduction of about 20 per cent.

To illustrate (Fig. 8) a typical side-sill rocker-panel assembly such as now used in unit-body frame cars is shown in carbon steel, and again as redesigned with high-strength low-alloy steel. Note that the metal has been redistributed, by having double thicknesses at the top and bottom to take efficient advantage of the greater strength of the high-strength low-alloy steel, and at the same time to avoid increased deflection. The weight reduction is again about 20 per cent, and the cost saving nearly 10 per cent.

Resistance to local buckling in the web sections of beams, channels and box sections can be increased tremendously by pressing in corrugations. Also, bulkheads may be added in box sections, and stiffeners in channels and beams.

Another way of getting addi-

(*Turn to page* 103, *please*)



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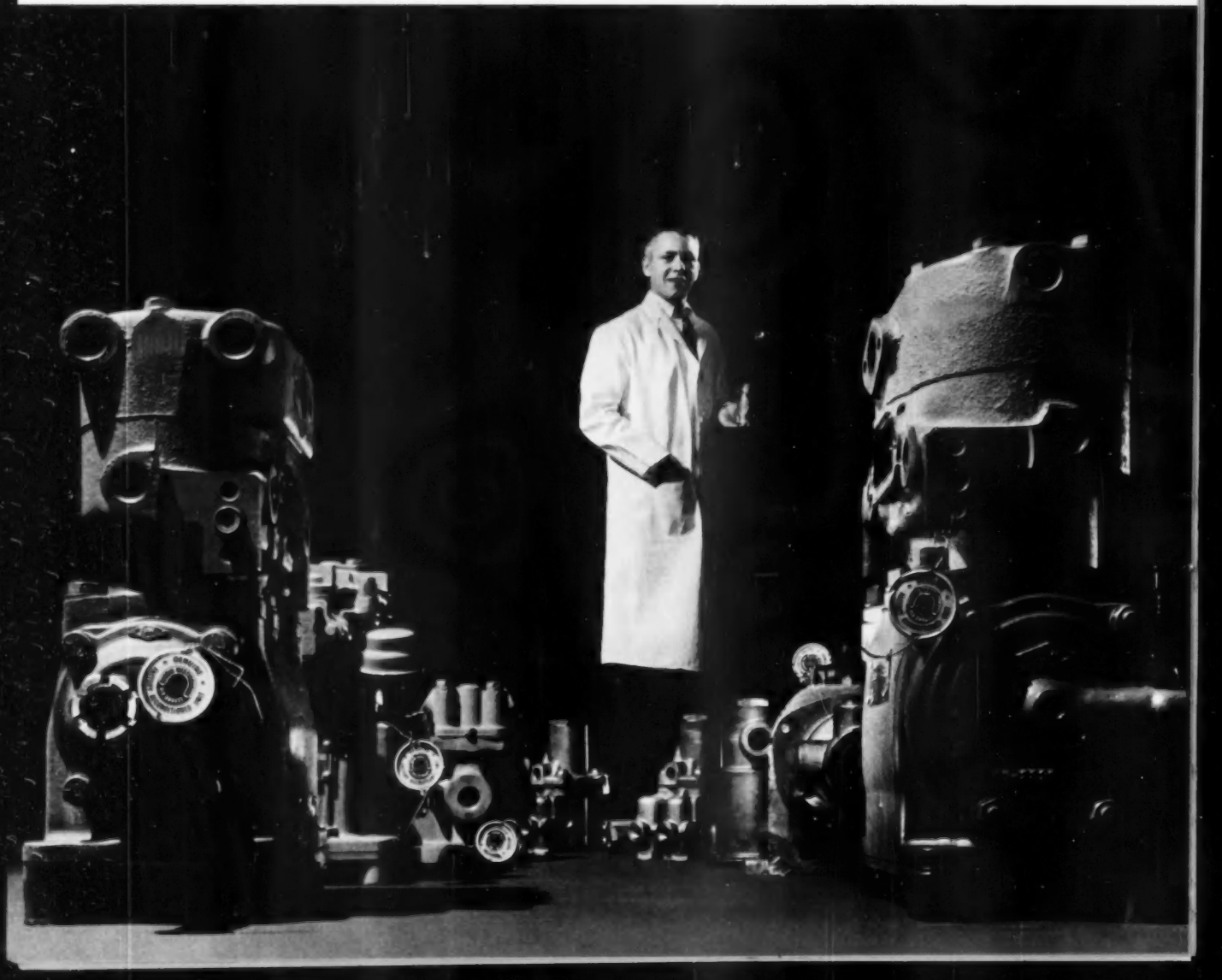
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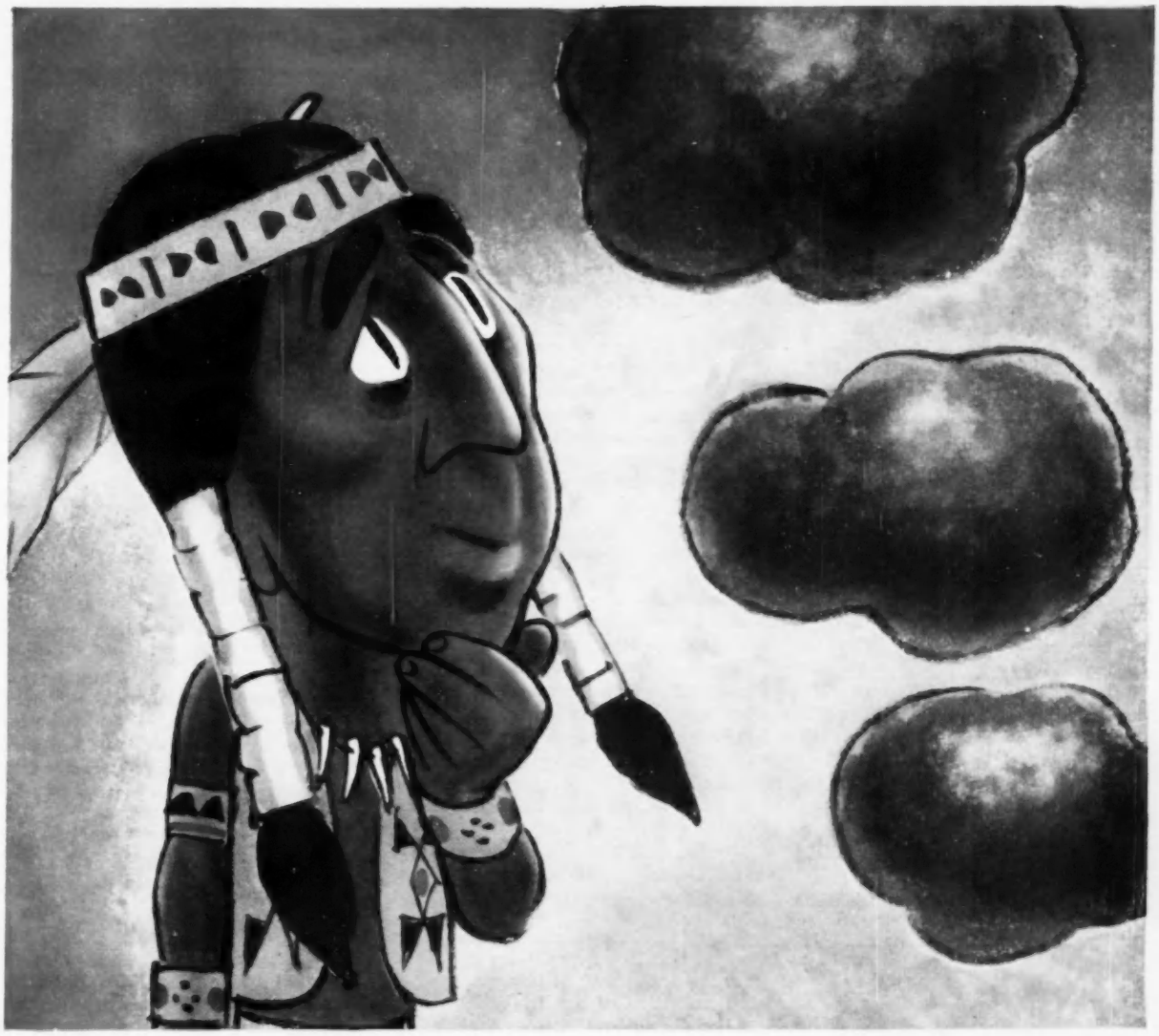
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NEW PRODUCTS AUTOMOTIVE-AVIATION

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By C. J. Kelly
ASSISTANT EDITOR

Hydraulic Power Units

A complete line of hydraulic power units now available range from ½ to 10 hp. They also range from 1.7 to 13 gpm at 1250 and 500 psi. These power units are portable, or semi-portable. Weight ranges from 20 to 770 lb.

These units come complete and ready to operate. Some are hand operated, others are foot operated. Most units can be operated by solenoid remote controls. *W. A. Whitney Mfg. Co.*

Circle 50 on postcard for more data

Layout Sheet

A new tooling material, magnesium phototemplate and layout sheet, is announced. According to the report, the material possesses excellent flatness and is recommended for both the diazo and blueprint methods of reproduction. Development work is continuing to make the product acceptable for photographic reproduction methods. It is supplied chemically treated with a chrome pickled surface ready for priming or coated with a primer of the user's choice.

In addition to flatness, Dow attributes these advantages to the product: lightness—magnesium offers the lightest weight of any sheet-metal tooling material and thus can reduce worker fatigue and freight charges. A 0.051-gauge sheet measuring 48 by 144 in. weighs 22.6 lb in magnesium, 34.9 lb in aluminum and 99.8 lb in steel. Machinability—magnesium, the most easily machined structural metal, reduces fabrication manhours involved in sawing and hand filing of templates.

Paint adhesion—primers that will accept diazo and blueprint emulsions adhere very well to magnesium. No chipping or flaking of the primers occurs when the metal is sawed or filed.

Stability — magnesium alloys possess excellent dimensional stability. Also, the coefficient of thermal expansion of magnesium (0.000015) so that dimensional variation is consistent when magnesium is used with these other materials in layout and template programs.

Alkali resistance — magnesium resists corrosion from plaster when used as station-line templates in the construction of full-scale mockup assemblies.

Magnesium phototemplate and layout sheet is furnished in widths up to 60 in., lengths up to 168 in. and thicknesses up to 0.090 in. *The Dow Metal Products Co., Div. of The Dow Chemical Co.*

Circle 51 on postcard for more data

New Car Ceiling

Acoustical Topliner is the name given to automotive ceilings manufactured from laminated fiber glass. This product has been designed to muffle air-borne noises and vibrations and will be introduced in the 1961 American Motors line, in October. According to the manufacturer's report, busses, trucks and aircraft are potential fields for the application of this material.

Installation of the Topliner can be accomplished by two workmen on the automotive production line. It is said to give up to three quarters of an inch more room and is contoured to fit snugly to the automobile's roof.

A feature of beauty is the unbroken ceiling since the headliner is constructed with no seams. *Johns-Manville Corp.*



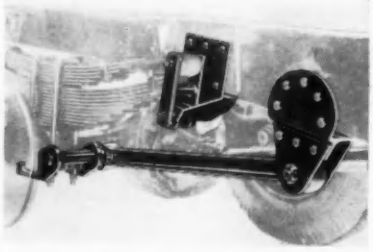
New Acoustical Topliner is joint development of the styling-engineering staffs of Johns-Manville Corp. and American Motors Corp. A feature of the material is that it is available in colors to match the color theme of the automobile it will be installed in.

Circle 52 on postcard for more data

Radius Rods

Specifically designed to carry driving and braking forces directly to the frame and let springs carry only the load, these new radius rods save both center-bolt and spring leaves from damage, according to the company report.

Once installed, manufacturer states, these radius rods never need adjustment and keep the driving axle perfectly aligned—thus eliminating excessive tire wear.

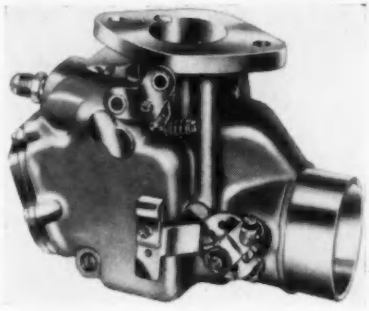


The use of lifetime rubber bushings act as shock absorbers. Life-testing of these bushings indicate that they will outlast any truck. *Truckstell Mfg. Co.*

Circle 53 on postcard for more data

Aluminum Carburetor

DESIGNED for application on farm and industrial equipment, a new solid aluminum, one piece gasoline carburetor embodies many features which adapt it to modern, high hp engines. This tiny unit is a compact 1½ in. in size and weighs only 4 lbs. Made of aluminum permanent mold,



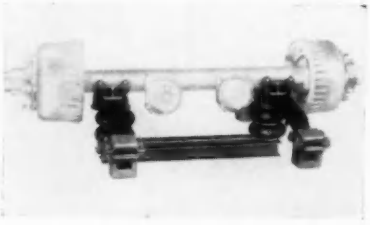
single casting construction, it incorporates venturi sizes up to 1-5/16 in. A stainless steel throttle shaft operates on needle bearings. The unit is available with power adjustment on either side. *Marvel-Schebler Products Div., Borg-Warner Corp.*

Circle 54 on postcard for more data

Load Equalizer

The model SA-107 "equal ride" suspension for semi's and trailers is engineered to take care of the tremendous difference between the empty and loaded weight of a trailer and smooth out the ride under all operating conditions.

Air in the air cushions can be preset to carry the empty trailer weight.



The leaf springs and air cushions together carry the combined weight of the trailer and payload. *Western Unit Corp.*

Circle 57 on postcard for more data

Multi-Use Adhesive

Epoxy glue, reputed to bond "anything to anything" is said to form a hard, permanent adhesive, stronger than materials themselves. It is waterproof, transparent and has many industrial and manufacturing uses.

A list, prepared by the manufacturer, states that epoxy glue attaches these materials to themselves and each other: steel, aluminum, brass, copper, iron, glass, wood, pottery, porcelain, leather, masonry, plastics, china.

Known as Magic Epoxy Glue, it comes in a two tube package—one each of resin and hardener. A free metal mixing pan is included. *Magic Iron Cement Co., Inc.*

Circle 55 on postcard for more data

Plastic Air Filter

Named the AAF Foamat, a new unit air filter employing a single sheet of synthetic plastic material, has been developed.

Sponge-like in appearance, Foamat breaks an air stream into little jets as it passes through the filter. Dust and dirt cannot follow and are trapped in great quantities by the cells. Designed as a permanent filter,



Foamat will not pack, settle, separate or develop 'thin' spots.

It completely eliminates media replacement and offers greatly reduced maintenance. It can be washed with a standard spray-head hose nozzle without removing the filter from the filter bank. Where stubborn process dusts are encountered the filters may be removed, soaked in a mild detergent, rinsed with cold water, and reset in place.

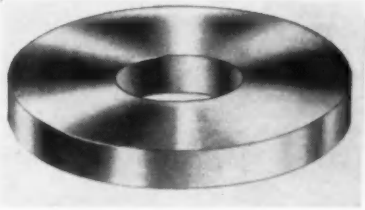
This filter media is pleated into a holding frame in order to present the greatest possible area for dirt storage. Foamat is resistant to all moisture and vermin and is chemically treated for permanent flame resistance, the manufacturer reports. *American Air Filter Co., Inc.*

Circle 58 on postcard for more data

Nylon Washer

This flat nylon washer is reported to be ideal for use as a spacer or as an insulator and can be used on any screw, bolt, pin, nail or rivet.

Because of the low coefficient of friction of nylon against metals, these washers provide inexpensive bear-



ings that require no lubrication. The washers can also be used to prevent corrosion as the nylon insulates dissimilar metals. The natural resilience of nylon enables the washer to absorb shock and vibration.

The manufacturer claims these flat nylon washers are excellent for use in making fastenings to highly finished porcelain or ceramic materials because the washer cushions the pressure of the fastener and permits it to seat the required tightness without the danger of cracking, chipping, or crazing of the surface.

Made of *DuPont* nylon which meets specification MIL - P - 17091 - B, the washer has a tensile strength of 15,000 psi. Flat nylon washers are available from stock in sizes up to ½ in. OD to fit screws from number 3 through ⅜ in. diameters. Special sizes can also be made to order. *Nyltite Corp. of America.*

Circle 56 on postcard for more data

Film On Welding

The availability of a 16mm film, in full color and with sound, entitled "Fundamentals of manual shielded arc-welding techniques" has been announced. The film comes in two parts. Part one covers flat and horizontal arc welding techniques and is 22 minutes in length. Part two concerns itself with vertical and overhead welding and runs for 23 minutes. The primary purpose for the film is training. In addition to the four basic types of arc welding both good and bad examples of welding are shown. This free of charge film can be obtained from the local agent listed in the telephone directory. *Air Reduction Sales Co., Inc.*

Circle 59 on postcard for more data



NEW "TORTURE CHAMBER" FOR RADIAL BEARINGS

duplicates military acceptance tests

This is a torture chamber for radial bearings. Here BCA ball bearings are run . . . hour after hour . . . under loads of 5000 pounds per bearing – matching military acceptance tests for radial bearings. This special BCA-built device is an important control and development tool. It provides essential data for BCA's ball bearing research program.

This tough performance test is an example of the greatly expanded research and testing facilities which BCA has developed for the benefit of bearings users. Reason: to provide the finest possible ball bearings to customers. Results: bearings which consistently exceed performance specifications on whatever kind of jobs they are designed for.

Among the extensive new facilities at the BCA laboratories is a Temperature-Humidity-Controlled Instrumentation Room containing precision instruments, many of which have been specially designed and modified for bearing research. There are a number of unusual testing devices, too; in design, identical to equipment in customers' plants. On these, BCA bearings can be tested *under the exact operating conditions specified by the customer.*

BCA provides a complete line of ball bearing sizes and types for nearly every kind of industry. They're standard original equipment on automotive, machine tool, earth moving, and agricultural equipment, for example. And, you'll find BCA a dependable source not only for high-performance ball bearings but engineering assistance, should you need it. For more information, contact Bearings Company of America, Division of Federal-Mogul-Bower Bearings, Inc., Lancaster, Pa.

BCA

BEARINGS COMPANY OF AMERICA

ball bearings

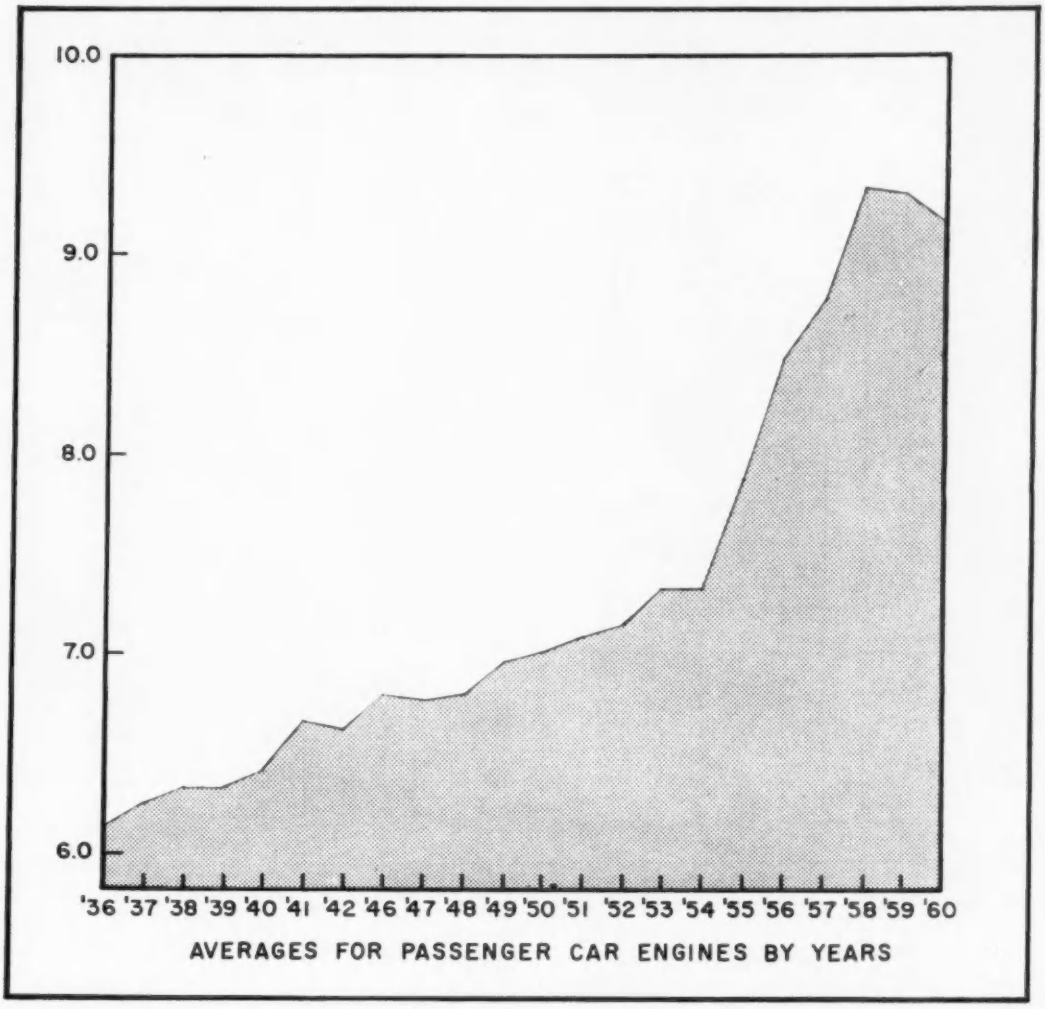
DIVISION OF FEDERAL-MOGUL-BOWER BEARINGS, INC.

Circle 144 on Inquiry Card for more data

A.I. AUTO-TECHNICS DATA SHEETS

Basic Automotive Design and Production Technical Data For Permanent Reference

AVERAGE COMPRESSION RATIO, 1936—1960



Average Compression Ratio

1936	6.14	1950	7.00
1937	6.25	1951	7.09
1938	6.32	1952	7.14
1939	6.32	1953	7.31
1940	6.41	1954	7.31
1941	6.63	1955	7.87
1942	6.60	1956	8.47
1946	6.77	1957	8.75
1947	6.73	1958	9.32
1948	6.78	1959	9.30
1949	6.93	1960	9.15

TEAR OUT ON THIS LINE

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• • INDUSTRY STATISTICS • •

By Marcus Ainsworth
STATISTICAL EDITOR

WEEKLY U. S. MOTOR VEHICLE PRODUCTION

As reported by the Automobile Manufacturers Association

Make	Weeks Ending Oct. 29	Weeks Ending Oct. 22	Year to Date 1960	Year to Date 1959
PASSENGER CAR PRODUCTION				
Total—American Motors	11,450	10,593	401,320	325,015
Chrysler	1,671	1,724	71,810	58,386
De Soto	240	232	18,413	37,329
Dodge	5,249	4,771	328,401	148,260
Imperial	480	479	13,814	17,612
Lancer	3,254	2,922	36,180	
Plymouth	4,664	4,735	214,289	348,117
Valiant	2,548	2,193	207,059	4,381
Total—Chrysler Corp.	18,106	17,056	891,766	614,065
Comet	4,657	6,219	165,742	29,487 *
Falcon	11,813	9,488	428,367	30,365
Ford	21,976	26,094	829,314	1, 34,046
Lincoln	427	160	14,080	23,092
Mercury	4,732	4,421	132,281	129,027
Total—Ford Motor Co.	43,605	46,382	1,569,784	1,446,017
Buick	7,802	6,872	219,999	206,325
Buick-Special	2,629	2,050	15,106	
Cadillac	3,902	3,802	129,975	126,651
Chevrolet	33,279	32,520	1,334,107	1,250,040
Corvair	6,506	6,560	205,914	50,097
Oldsmobile	6,979	7,393	303,479	337,120
Oldsmobile-F85	2,515	2,587	17,859	
Pontiac	8,611	7,010	360,327	360,153
Tempest	2,167	1,407	5,172	.....
Total—General Motors Corp.	74,290	70,201	2,591,938	2,330,386
Total—Studebaker-Packard Corp.	2,588	2,559	91,492	126,783
Checker Motors	87	152	6,052	3,679
Total—Passenger Cars	150,126	146,943	5,552,352	4,847,945
TRUCK AND BUS PRODUCTION				
Chevrolet	7,957	7,540	331,651	297,911
G. M. C.	1,755	1,382	88,670	70,276
Diamond T	20	20	2,275	4,834
Divco	.....	.....	3,256	3,156
Dodge and Fargo	1,417	1,554	61,019	66,068
Ford	2,303	519	76,480	288,123
F. W. D.	11	.....	761	895
International	1,860	2,218	105,722	123,363
Mack	281	276	12,676	14,746
Studebaker	326	212	11,034	10,563
White	247	221	13,620	16,777
Willys	1,749	2,083	107,959	96,791
Other Trucks	80	80	3,705	3,201
Total—Trucks	18,006	16,105	1,018,828	996,704
Buses	80	115	3,495	2,105
Total—Motor Vehicles	168,212	163,163	6,574,675	5,846,754

*—Edsel production.

1960 TRUCK TRAILER SHIPMENTS

Industry Division, Bureau of the Census

Type of Trailer	August	Eight Months 1960	Eight Months 1959
Vans			
Insulated and refrigerated	395	4,013	3,664
Steel	34	575	393
Aluminum	361	3,438	3,271
Furniture	93	1,611	1,104
Steel	67	1,407	918
Aluminum	26	204	186
All other closed-top	1,906	18,925	18,763
Steel	523	4,429	5,243
Aluminum	1,383	14,496	13,520
Open-top	215	2,044	1,968
Steel	43	572	801
Aluminum	172	1,472	1,167
Total—Vans	2,609	26,593	25,499
Tanks			
Non- and low-pressure			
Petroleum and aircraft refuelers			
Carbon and alloy steel	73	1,066	1,612
Stainless steel	23	181	204
Aluminum	126	1,249	1,173
Total—Petroleum	222	2,496	2,989
Chemical, food, and sanitary	59	532	335
Dry materials	30	934	1,169
High-pressure(LPG, chemicals, etc.)	22	240	233
Total—Tanks	333	4,202	4,726
Pole, pipe, and logging			
Single axle	13	153	252
Tandem axle	35	622	852
Total	48	775	1,104
Platforms			
Racks, livestock, and stake	28	297	341
Grain bodies	46	870	1,158
Flats, all types	565	6,461	7,100
Total—Platforms	639	7,628	8,599
Low-bed heavy haulers	150	1,460	1,769
Dump trailers	123	1,124	1,723
All other trailers	240	2,451	1,875
Total—Complete Trailers	4,142	44,233	45,295
Dump trailer chassis[1]	52	635	.....
Trailer chassis only[1]	327	2,251	2,762
Total—Trailers and Chassis	4,521	47,119	48,057
Detachable van bodies[1]	323	2,390	1,423

[1] Sold separately.

NEW PASSENGER CAR REGISTRATIONS BY REGIONS*

Zone	Region	August 1960	July 1960	August 1959	Eight Months 1960	Eight Months 1959	Per Cent Change Aug. over July	Aug. over Aug. 1959	Eight Months 1960 over 1959
1	New England	30,328	32,695	26,536	258,279	219,313	−7.24	+14.29	+17.77
2	Middle Atlantic	107,199	114,018	91,247	886,807	742,868	−5.98	+17.48	+19.38
3	South Atlantic	69,507	65,127	69,668	593,992	550,431	+6.73	− .23	+ 7.91
4	East North Central	123,560	136,240	133,636	1,128,786	1,072,216	−9.31	− 7.54	+ 5.28
5	East South Central	22,857	24,579	26,253	204,550	188,033	−7.01	−12.94	+ 8.78
6	West North Central	49,784	46,104	46,993	374,484	377,802	+7.98	+ 5.94	− .88
7	West South Central	43,967	45,570	52,282	361,332	364,652	−3.52	−15.90	− .91
8	Mountain	19,161	19,692	21,249	154,700	152,501	−2.70	− 9.83	+ 1.44
9	Pacific	59,037	62,510	65,772	520,174	520,083	−5.56	−10.24	+ .02
	Total—United States	525,400	546,535	533,636	4,483,104	4,187,899	−3.87	− 1.54	+ 7.05

States comprising the various regions are: Zone 1—Conn., Me., Mass., N. H., R. I., Vt. Zone 2—N. J., N. Y., Pa. Zone 3—Del., D. of C., Fla., Ga., Md., N. C., S. C., Va., W. Va. Zone 4—Ill., Ind., Mich., Ohio, Wis. Zone 5—Ala., Ky., Miss., Tenn. Zone 6—Iowa, Kan., Minn., Mo., Neb., N. D., S. D. Zone 7—Ark., La., Okla., Tex. Zone 8—Ariz., Colo., Ida., Mont., Nev., N. M., Utah, Wyo. Zone 9—Alas., Cal., H. I., Ore., Wash.

* Compiled from official state records. Data property of R. L. Polk & Co. May not be copied, sold or reprinted without Polk permission.

1960 TRUCK FACTORY SALES BY G.V.W.

As reported by the Automobile Manufacturers Association

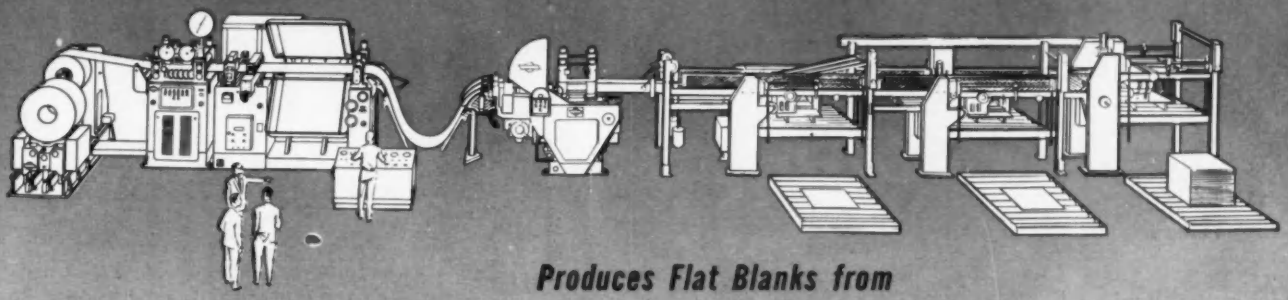
Period	6,000 lb. and less	6,001-10,000 lb.	10,001-14,000 lb.	14,001-16,000 lb.	16,001-19,500 lb.	19,501-26,000 lb.	26,001-33,000 lb.	Over 33,000 lb.	Total
First Quarter	205,599	56,758	3,747	9,305	53,754	20,834	10,805	10,037	368,919
Second Quarter	189,711	51,817	3,052	9,931	48,018	20,534	10,687	10,283	344,033
Total—6 Months	395,310	108,575	6,799	19,236	101,772	41,368	21,492	20,320	712,952
July	37,576	13,103	917	3,283	13,016	6,151	2,711	2,685	79,444
August	33,758	9,745	668	2,888	10,640	4,156	2,102	1,991	65,948
September	41,662	10,948	917	2,120	12,477	4,523	2,324	2,067	77,038
Total—9 Months—1960	506,386	142,371	9,301	27,527	137,907	56,198	28,629	27,063	935,382
Total—9 Months—1959	462,965	140,529	11,324	74,396	111,835	49,649	32,141	30,389	913,228

ONE SOURCE... LITTELL



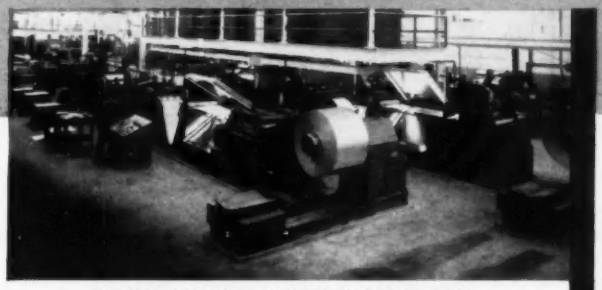
engineers, integrates and guarantees this

HIGH SPEED SHEETING LINE



Produces Flat Blanks from Coil Stock .0055" to .020" ACCURATELY—within .007" in Length and Squareness FAST—75 three-foot blanks per minute!



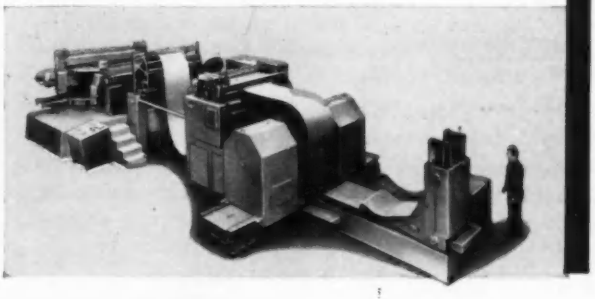


TYPICAL LITTELL TINPLATE SHEETING LINES

At Crown Cork & Seal Company, these lines convert coil stock into flat sheeted tinplate, cut square, and to accurate lengths, in one continuous, automatic operation.

TYPICAL LITTELL TRAPEZOID SHEETING LINE

For The Budd Company, this Littell Trapezoid Sheeting Line converts heavier coil stock into custom cut rectangular, parallelogram and trapezoidal flat blanks for subsequent stamping and drawing operations.



The accuracy, the speed, and the low cost production record of this Littell line has made it standard equipment with the most exacting metalworking manufacturers. One company alone has 24 of these lines producing flat blanks. In every instance where the line has gone into service, the user has ordered more!

Littell engineers *and guarantees* the five complex individual units in the line to operate as one. Each unit is integrated and synchronized, one with the other, to produce flat blanks from mill coils faster, more accurately and at lower cost than has been possible before. Littell *guarantees* a tolerance of ±.007" in length and squareness in producing blanks up to 36" long at the rate of 75 blanks per minute. You get this accuracy on paper-thin .0055" tinplate or steel stock .020" thick. Operation is automatic, controlled by one man. Imperfect blanks are automatically rejected by electronic controls. Can manufacturers report the Littell line's scroll cutting efficiency saves six percent in material.

Whether you work thick or thin stock, a Littell Sheeting Line can work to your advantage and quickly pay for itself. Let's talk it over. 'Phone or write.





COILY SAYS: "When you call or write, be sure you ask for Bulletin G-10."

F. J. LITTELL MACHINE CO.

4111 N. Ravenswood Avenue, Chicago 13, Illinois
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ROLL FEEDS • SHEETING LINES • STRAIGHTENING AND FEEDING MACHINES • REELS AND CRADLES FOR COIL STOCK

Circle 117 on Inquiry Card for more data

National Aeronautic Meeting of the SAE

By R. Raymond Kay
PACIFIC COAST EDITOR

THIS country's space race with the Soviet Union is a "fact of life. And we don't dare fall behind," warns Courtland D. Perkins, assistant secretary of the Air Force for research and development.

Mr. Perkins says the Soviet Sputniks threw us a real challenge. And we are now in an all-out effort in scientific and military aspects of astronautics. "The total fiscal 1962 funding for major areas of space research will be well over $1.5 billion."

The aerospace industry is making supersonic strides in science and technology. The big emphasis is on turning out more hardware for less money, in less time.

But how to span the spectrum from research to hardware? That's the big question.

The five-day Society of Automotive Engineers National Aeronautic Meeting tried to come up with some of the answers. This year's event was a triple header. There was an Air Force Astronautic Symposium and an Aerospace Manufacturing Forum in addition to the regular program.

The Los Angeles meeting drew several thousand scientists, design and production engineers, and aerospace executives. It was the largest SAE meeting in history, both in number of papers and sessions—94 papers and 40 sessions.

SAE really went all out with a most ambitious program. Some of the subjects covered: new manufacturing processes; astronautical vehicles, their propulsion, guidance, utilization; planetary and space environments; ground support equipment; turbine engines; reliability; and future air transports.

Here are some highlights of the Aerospace Manufacturing Forum. They're of special interest to AUTOMOTIVE INDUSTRIES readers:

New Manufacturing Techniques

Welding and Brazing

Welding is becoming much more important for missiles, space vehicles, and aircraft. This added impetus is going along at a very rapid rate. Reason: Need for weld-tight pressure vessels used in solid and liquid rocket cases, and in space vehicles.

That's the opinion of J. L. Waisman, assistant chief, Materials Research and Process Engineering, Douglas Aircraft Co., Santa Monica Div.

Most very-high-speed aircraft now designed require sandwich structures with rigid welded joints for structural efficiency.

We have many pressing problems in the welding field, Mr. Waisman says. One of the most important needs is high strength "as-welded" structures. These are needed for many of the pressure vessels which cannot be heat treated, because of distortion effects, or because of tremendous size alone.

Heat treated steel motor cases in the highest strength range which are heat treated after welding, need 100 per cent joint efficiency.

Mr. Waisman feels one controversy will continue for years. Which type of sandwich structures will finally prove the best compromise between cost, size, tolerances, and efficiency?

On high speed aircraft, probably the chief problem is in joining panels by resistance or fusion welding. Difficulties arise from very limited accessibility. The work has to be done in awkward positions on the assembly line. We must have close tolerances, minimum built-in stresses, and convenient methods for local thickening at the weld joint.

As to many of the refractory metals, Mr. Waisman says their technology cannot develop until we have reliable high strength welds for them.

L. Frost, senior tool engineer, Advance Programming, North American Aviation, talked about brazing trends.

As speeds and heights increase, the materials used and the joining processes must cope with weight, strength, and changing temperature problems.

Braze joining meets many of these conditions. It's coming into greater use. Sandwich structure made by brazing techniques gives lightweight, high strength, and good aerodynamic surfaces.

Internal plumbing for high pressure fluid retention at elevated temperatures can be joined within the structure by braze-in-place induction heating, Mr. Frost reports.

Producing details for honeycomb core brazed sandwich involves several new manufacturing processes. Tolerances for mating require ±0.002 in. total deviation to avoid gaps in the braze joint.

Mr. Frost pointed to four methods of brazing sandwich structures: (1) electric blanket concept, (2) die quench method, (3) salt bath technique, and (4) the more conventional furnace method.

(*Turn to page* 124, *please*)



SCHOOLWAY TRANSPORTATION CO., INC. says

"We doubled our average mileage with LIPE CLUTCHES"

"In our type of operation, our 90 buses average 28 to 30 stops per hour picking up children in traffic," says R. H. Paradise, president of Schoolway Transportation, Hales Corners, Wisconsin.

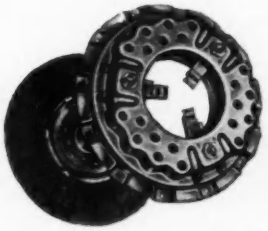
"Our average clutch life under this type of operation has been 20,000 miles. Our first Lipe Clutch was pulled at 39,000 miles – almost double our fleet average."

Like fleets of all types, Schoolway is interested in fundamental cost and performance: Unit cost. Reliability. Number of engagements between teardowns. Total mileage. Cost of labor and replacement. Loss of equipment use.

To these basic considerations Lipe Clutches give the answers: Longer equipment use. More engagements between teardowns. More total mileage. Lower average cost per mile.

These answers show up in fleet cost-analyses everywhere. They tell why, the Country over . . .

the trend is to LIPE!

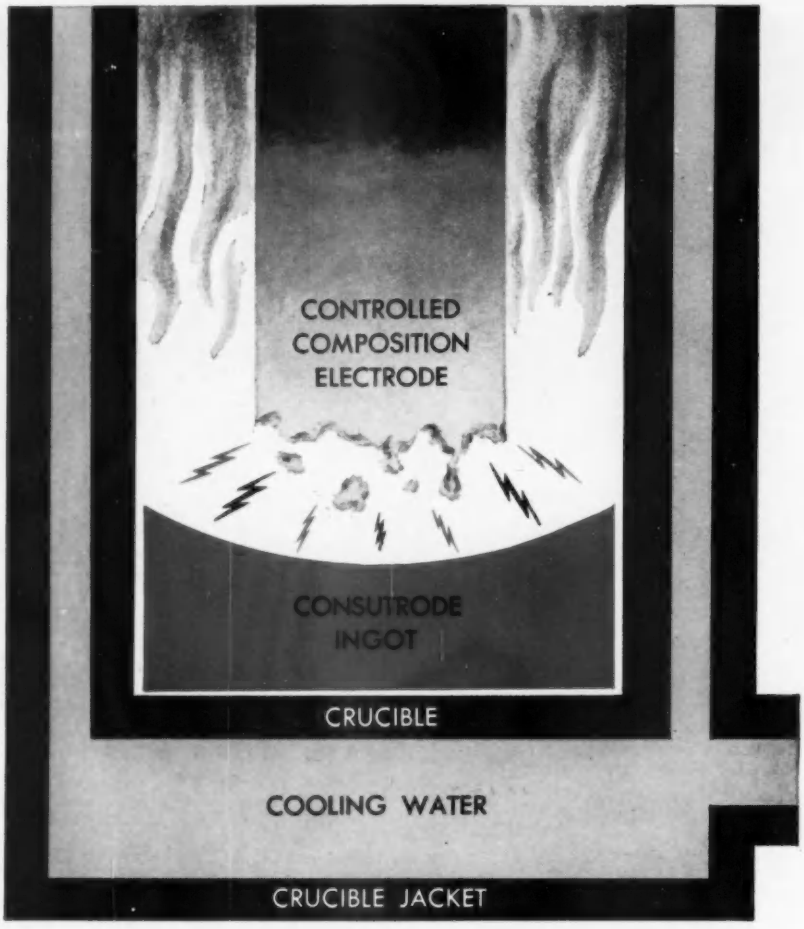


You can get Lipe Factory Exchange or Interchange Clutches for vehicles 18,000 lbs. G.V.W. and up. See your Lipe Jobber: He's listed in the Yellow Pages.

LIPE-ROLLWAY CORPORATION SYRACUSE 1, N.Y.

Circle 146 on Inquiry Card for more data

Vacuum Melting Extracts Impurities



Improved soundness, better hot and cold workability, higher mechanical properties, cleaner metal with lower gas content—these are the characteristics of vacuum melted steels from Allegheny Ludlum.

Typical of the metals produced by vacuum melting are Consutrode® steels and alloys. They provide outstanding cleanliness and homogeneity at minimum cost. These alloys, pioneered by Allegheny Ludlum, are available in the largest ingot sizes of any vacuum melting process—up to 20,000 lb. ingots. This makes possible larger products of high quality in super alloys, stainless, tool, and low alloy steels.

Consutrode alloys are made by vacuum remelting electrodes of a predetermined composition by an electric arc. The white heat of the arc—8000 F—breaks down many nonmetallics in the electrode. Considerable degasification, as well as substantial improvement in cleanliness, is achieved by the furnace vacuum which removes the oxides and nitrides released in melting of the electrode.

Controlled solidification of the molten metal in a water-cooled crucible is a principal advantage of the consumable electrode vacuum process. This gives an exceptionally sound and homogeneous ingot.

Other recently developed methods for improving steels and properties of the improved alloys are described in a new booklet, "Modern Melting at Allegheny Ludlum." It includes a description of Special Air Melted Steels, Invac alloys made by induction vacuum melting, Invacutrode alloys made by remelting Invac electrode stock by the consumable electrode vacuum process, and Consutrode alloys.

This new booklet is packed full of charts and graphs—a real help to anyone who must get the most out of metals. Ask your A-L representative for a copy or write: ***Allegheny Ludlum Steel Corporation, Oliver Building, Pittsburgh 22, Pennsylvania. Address Dept. AI-11.***

ALLEGHENY LUDLUM
PIONEERING on the Horizons of Steel

2116

Circle 147 on Inquiry Card for more data



With the right woven pile from Schlegel

Moving this window up or down strains neither muscle nor motor.

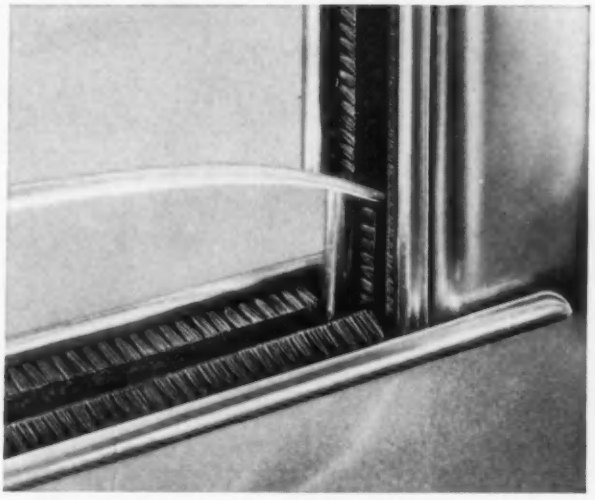
This is a significant accomplishment, considering the glass variances in today's automobile windows How does Schlegel pile liner make the job so effortless—yet still effectively seal out the elements and eliminate window noise?

The answer is yours. You select the glass run channel and specify Schlegel woven pile liner. We furnish the channel manufacturer with pile fabric of the correct specifications.

Our work doesn't end there. We give you a quality pile which will retain its wear-resistance for years and years to come.

To you (and your car-buyer), Schlegel woven pile liner means easier window movement, rattle-free windows and better sealing qualities. It hugs the glass surface evenly, flexing against wavy surfaces to hold a constant seal.

If that sounds good enough to make you want the best, be sure your next glass run channel utilizes Schlegel woven pile liner. You'll be in good company. Automotive engineers have been specifying Schlegel pile liner since glass windows were first used in cars.



Glass moves friction-free, wet or dry, in this glass run channel with Schlegel woven pile

Schlegel

SERVING THE AUTOMOTIVE INDUSTRY

SCHLEGEL MANUFACTURING COMPANY

1555 Jefferson Rd., Rochester 23, N. Y.
In Canada: Oakville, Ontario

Circle 148 on Inquiry Card for more data



From jet aircraft and missiles to automobiles and fractional horsepower motors, Purolator filters are part of advanced engineering design

Sixty-five Purolator filters perform vital functions on the Boeing 707, 720, Douglas DC-8, Convair 600 and Convair 880. Purolator filters form an integral part of such missile systems as the Hawk, Polaris, Jupiter, Atlas Terrier and Hound Dog.

In fact, we filter *all* fluids vital to the proper operation of aircraft, rockets, automobiles and other machines – be they air, fuels, lube oils, or hydraulic fluids. In each case, the Purolator filter is designed specifically for the job.

Do you have an engineering development in mind that would benefit by filtration? We're the world's largest, most-diversified maker of filters. Chances are, one of our more than 2,000 units will do the job. If not – we'll design and make a filter that will. Let us know your requirements.

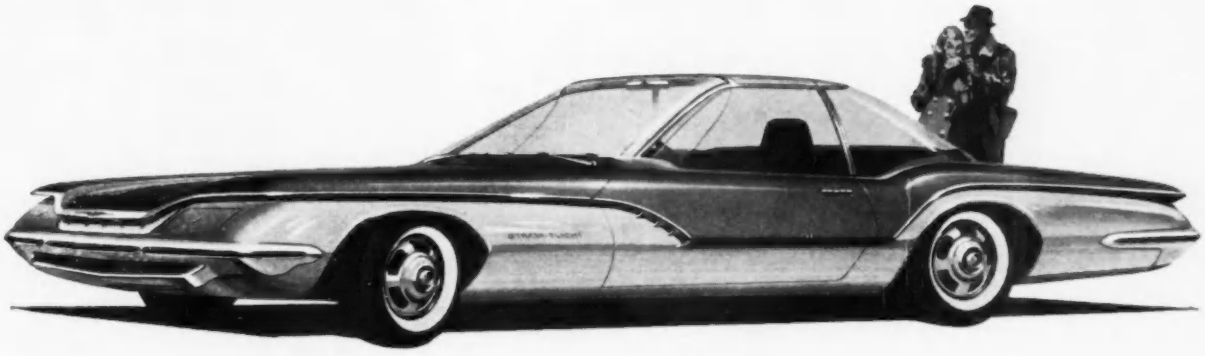
Filtration for Every Known Fluid

PUROLATOR

PRODUCTS, INC.

RAHWAY, NEW JERSEY, AND TORONTO, ONTARIO, CANADA

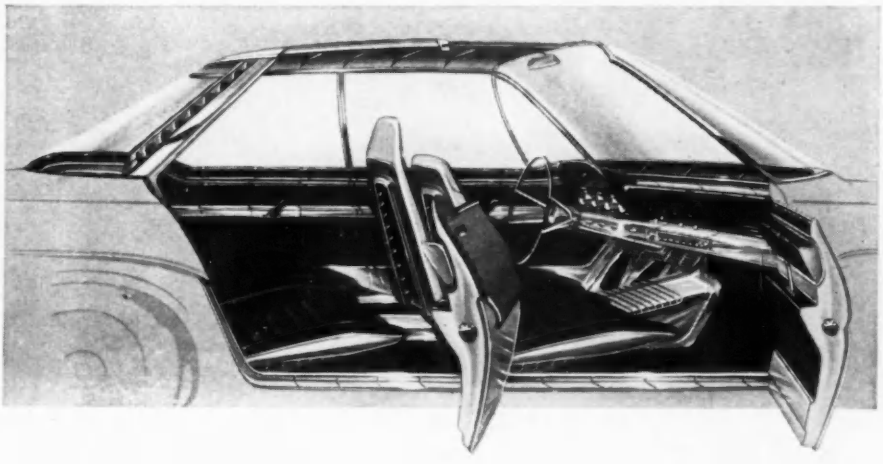
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stainless steel

No other metal has the strength, beauty and versatile qualities that serve you so well today and promise so much for tomorrow.

There is nothing like stainless steel for AUTOMOBILES



McLouth Steel Corporation,
Detroit 17, Michigan

Manufacturers of high quality Stainless and Carbon Steels

Look for the **STEELMARK** on the products you buy.

McLOUTH STAINLESS STEEL

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An axle has to be extra tough to take this kind of punishment. Low distortion induction heat treating makes it possible.

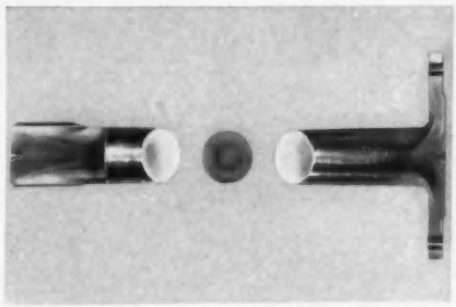
Why International Trucks shoulder bigger loads

Conventional heat treating just wasn't good enough for International Harvester's Fort Wayne Works. They wanted a process that would increase axle strength with minimum distortion. That's why they installed Westinghouse low distortion Induction Heating equipment at the Ft. Wayne truck plant.

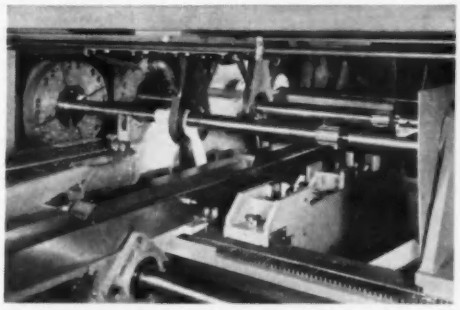
More than **150,000** IH truck axle shafts have been hardened with Westinghouse equipment, and none have required straightening!

Higher cost? Not with this new Westinghouse equipment. This method of induction hardening actually cuts costs . . . two ways. First, no cold straightening is required. Second, tests prove that axles made with 1041 carbon steel induction hardened with Westinghouse low distortion equipment are 100% stronger than axles made with higher-cost 4150 alloy hardened in a furnace. Westinghouse low distortion Induction Heating can bring you lower material and handling costs, fewer

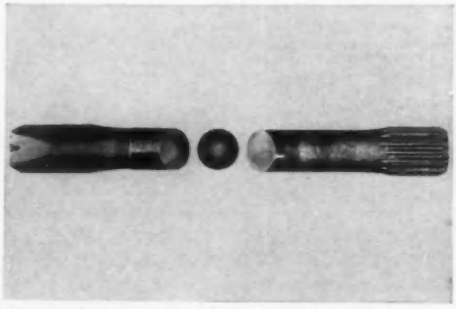




Westinghouse low distortion induction heating on a typical axle provided tensile strengths up to 290,000 psi using 1041 carbon steel. This compares with 185,000 psi using 4150 alloy and furnace heat treating.



The rugged Westinghouse Induction Scanner installs directly into the production line. No warm-up time required, no hot stock inventory. Equipment can be made to match your present and future production requirements.



Westinghouse induction heating offers more precise control of heated depth making it possible to replace a furnace treated alloy steel with a low carbon type.

without Axle Failure

replacements, and more satisfied customers. For details, call or write your Westinghouse representative, or Westinghouse Electric Corporation, Industrial Electronics Department, Baltimore 3, Maryland. You can be sure . . . if it's Westinghouse.

Westinghouse

J-35016

Circle 151 on Inquiry Card for more data

Czech Plant Tooling

(*Continued from page* 71)

At the same time, there are the first indications that the Czechs are looking to the West to fill their own production gaps. One example is the complete tooling for making car and truck wheel rims, recently purchased from Dunlop at a cost of $1½ million, which started operation at Ostrava this year.

The British firm worked closely with Czech engineers in designing the equipment for available materials (e.g. rims are formed from 18-ft rather than continuous lengths of strip steel), and for use in conjunction with local press lines for the wheel centers. The semi-automatic installation is now capable of meeting the needs of the country's entire auto industry.

Among other vehicle manufacturers, Tatra is testing Dunlop disk brakes on its V-8-engined T603. It is also negotiating with Hobbs for the local manufacture of their Mecha-Matic transmission, a choice governed by the compact size of the British automatic unit which makes it suitable for mounting ahead of the differential on this rear-engined car. ■

MODERN STEELS
for Lighter Automobiles

(*Continued from page* 86)

tional support in closed strength members and hollow panels is to fill them with a rigid structural foam, such as polyurethane or a blend of polyurethane and polystyrene. So filled, the structures have remarkable stiffness and better resistance to denting and buckling. Also, the foam prevents internal corrosion and has excellent sound-deadening and insulating properties.

This construction is being tried in station wagon tail gates and decks, and foam-filled passenger car doors are being tested. ■

The foregoing article is an abstract of a paper presented by the author at The American Society of Body Engineers, Inc., Detroit, on October 27, 1960

NATIONAL OIL SEAL LOGBOOK

Presenting!

NATIONAL BUD UNITIZED

TRADE MARK

Flanges, if desired, are available to simplify positioning and removal



National BUD UNITIZED has integral wear ring presenting rubber surface to shaft. Wear ring turns with shaft, sealing lip is never exposed to damage, cannot score shaft.

A new unitized oil-seal-and-wear ring that eliminates:

SHAFT WEAR OR SCORING

SEPARATE METAL WEAR SLEEVES

EXPENSIVE SHAFT FINISHES

COSTLY SHAFT RE-MACHINING

SEALING LIP INSTALLATION DAMAGE

SPECIAL INSTALLATION PROCEDURES

New National BUD UNITIZED seals are now in production, in a limited range of sizes, for heavy oil and grease sealing applications — including truck, bus and tractor uses. Still newer BUD UNITIZED seals are on the way for higher speed automotive and similar uses.

Changing a National BUD UNITIZED oil seal automatically changes the wear sleeve — in one fast, simple operation. Since the seal has its own integral wear ring, it is almost impossible to install it other than squarely on the shaft. Expensive shaft finishing is no longer a necessity, nor is leakage under a metal wear ring a problem — both thanks to the rubber surface BUD UNITIZED presents to the shaft.

For complete details or skilled engineering help on application of BUD UNITIZED seals, write direct, or call your National Seal Applications Engineer. You'll find him in the Yellow Pages, under Oil Seals.

NATIONAL SEAL

Division, Federal-Mogul-Bower Bearings, Inc.
General Offices: Redwood City, California
Plants: Van Wert, Ohio, Redwood City and Downey, California



6013-R

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Circle 153 on Inquiry Card for more data

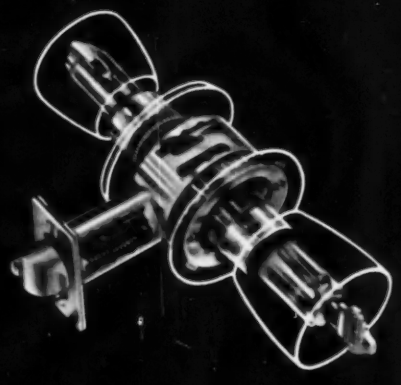
Extra years of fine lock service

-thanks to Superior Stainless

STRIP STEEL







Inside Schlage's all stainless lock; easy-working for a lifetime with Superior Stainless non-corrodible knobs, rose and internal mechanism.

The finest lock of its kind in the world, this pride of the Schlage Lock Company is built entirely of stainless steel—outside and in. Designed for institutional, commercial and marine use, it will deliver many years of faithful service undimmed by corrosion, tarnish, chipping or peeling because it's *solid* Superior Stainless . . . the stay-bright, easy-to-fabricate metal for your toughest applications. • Find out how Superior Stainless Strip Steel can better your present products and the ones to come. Consult a Superior sales engineer for facts you can use right now!

SUPERIOR STEEL DIVISION

OF

COPPERWELD STEEL COMPANY

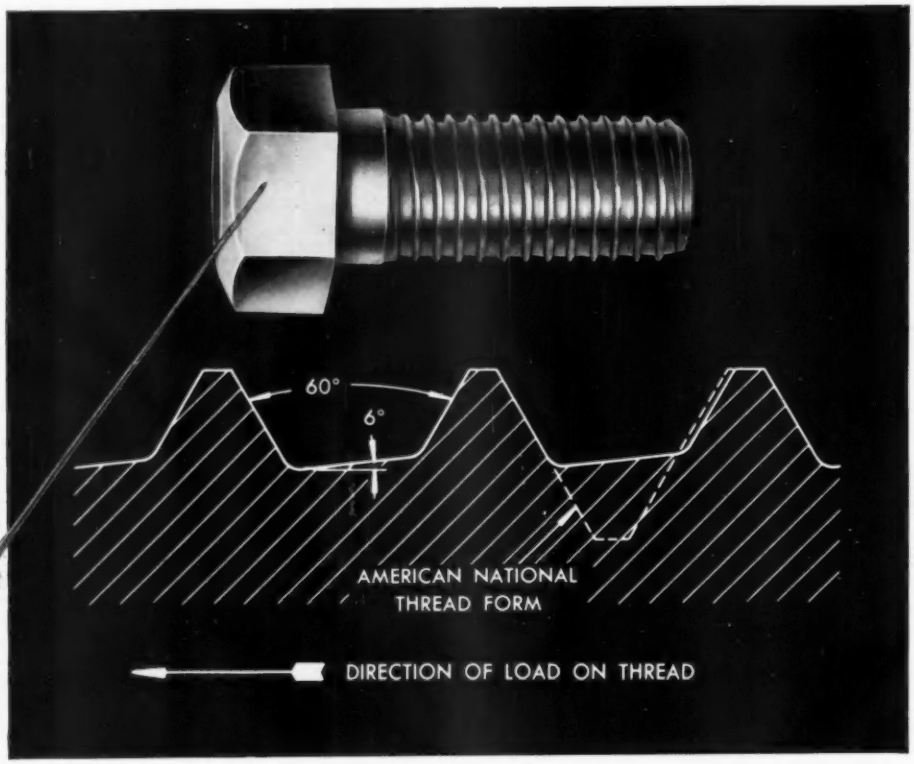
CARNEGIE, PENNSYLVANIA

For Export: Copperweld Steel International Company, New York

Stainless Steel

NAT'S quick facts about Fasteners...





Can **any** fastener actually **become tighter** in service?

WELL, HARDLY. NOT JUST *ANY* FASTENER...

But self-locking, extra-strength LOK-THRED® bolts, studs and screws *do*, and even after long service you can expect their breakaway removal torque to average about 70% higher than at installation.

Here's the reason. Just take a look at the LOK-THRED profile. Notice the extra-wide root? And its converging angle? It's held, strictly by design, to exactly 6 degrees.

Now, see what happens, as you drive any LOK-THRED fastener. It re-forms the metal of the receiving thread, squeezing out every void, and forming an intimate metal-to-metal contact. And each of the angled roots becomes a 6-degree tapered wedge, with the loading constantly pulling against it to make its anchorage even firmer.

That's why LOK-THRED fasteners actually *do* become tighter in service. They're self-sealing, too . . . fluids can't leak past them. And yet they're fully reusable . . . require no selective fits . . . can be used with ordinary tools.

Take our word for it, there are plenty of reasons* why LOK-THRED is superior for many kinds of fastening . . . and we'll be glad to help you develop any applications to your own products.

*They're all given in National's LOK-THRED booklet, with plenty of supporting data. Write for your copy.



National PRODUCTS

The National Screw & Mfg. Company • Cleveland 4, Ohio

California Division, The National Screw & Mfg. Company • 3423 South Garfield Avenue, Los Angeles 22, California

Circle 154 on Inquiry Card for more data



Independent quadrilateral suspension by Mather about 300 B.C.

LET MATHER SOLVE YOUR SUSPENSION PROBLEMS, TOO

The suspension "techniques" applied to this and the conveyances illustrated in our preceding advertisements* can quite properly be termed "far fetched". But, even though somewhat ridiculous, they are based on sound principles.

For the past 50 years Mather has concentrated its resources on the development and advancement of "ridability". So . . . if you have a problem or a project and would like to take advantage of our research, engineering and design facilities, please call CH 3-3201 or write,

MATHER

THE MATHER SPRING COMPANY

TOLEDO, OHIO

**If you've enjoyed this low pressure series and would like reproductions (cartoons only) they're yours for the asking.*

Meet the AI By-Liners



A brief biographical sketch of the editors and contributors to AI whose by-lines appear regularly

Introducing
C. B. Campbell

C. B. (Soup) CAMPBELL, News Editor, is a veteran Philadelphia and New York newspaperman. He edits copy and supervises the news production of staff and correspondent editors in the major industrial centers of the United States and Western Europe.

Starting as a copy reader 35 years ago, he was a reporter, rewrite man, copy reader, slot man, makeup editor, telegraph editor and picture editor during his long tenure at *The Philadelphia Inquirer*. He also was a copy reader on the *New York Journal-American* and *Elizabeth (N. J.) Daily Journal*.

"I hold the dubious distinction," he says, "of sending an edition to press later than any other makeup editor in the *Inquirer's* history."

It was during World War II that an edition was held for 45 minutes while awaiting word from Washington of a U. S. victory in the lean days of fighting in the Pacific.

"It was worth the wait, but I lost a few hairs in the interim," Campbell said.

Father of two boys and a girl, Campbell has lived in Westmont, N. J., for 20 years. He likes the location of his home because of excellent highways leading to New Jersey seashore points. He frequently visits these resorts in summer and winter. In summer, he admits, he mostly lounges on the beach. Sometimes he goes deep sea fishing with his children.

His main hobby, besides his children, is roses.

"I interested a neighbor in roses some years ago," he relates. "Now the neighbor wins top prizes at Philadelphia and South Jersey rose shows. I help him with my congratulations, but my own roses show they have been neglected because of too many trips to the shore."

"Soup" is a member of the Philadelphia Chapter of *Sigma Delta Chi* Professional Journalistic Fraternity.

Bendix-Westinghouse Tests

(*Continued from page* 59)

In addition, samples may be subjected to a synthetic reservoir drainage. These drainage accumulate in air brake systems as the result of vapors condensing from the compressed air which includes engine exhaust fumes, polluted industrial atmospheres, etc. Bendix-Westinghouse synthesizes reservoir drainage in order to have a standard for the tests. Test samples are observed as to their volume change and the coating's resistance to the drainage which is composed largely of water and dilute complex organic acids.

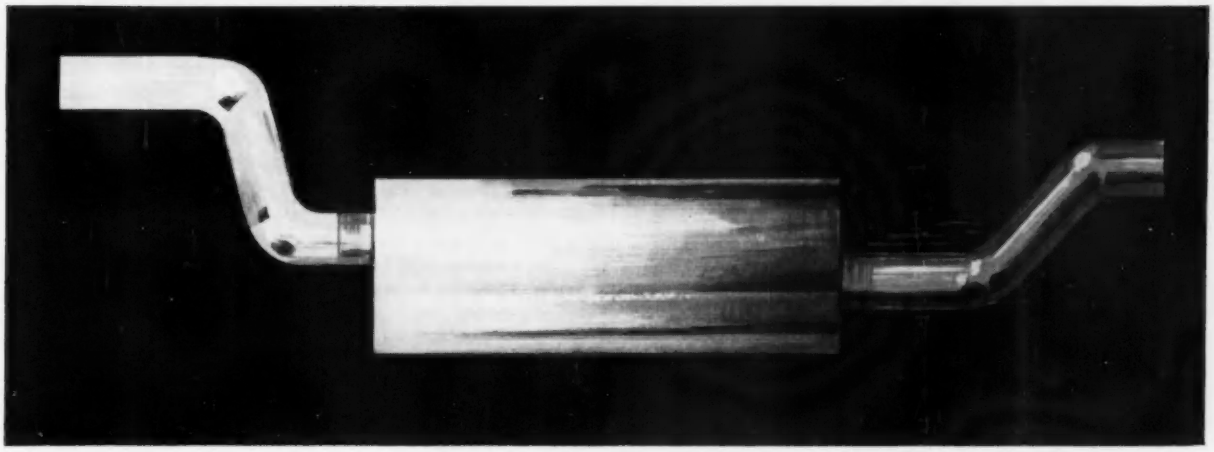
Tensile Strength. (Grab tensile) is tested in a Baldwin-Lima-Hamilton universal tester. Requirements for the application are a minimum of 250 by 275 lb/in.

Operational Tests. A specially constructed panel with compressed air supply permits duplication of the many different air loads to which each of the air brake components may be subjected. A system of air gages, timers, counters, etc. registers every type of load and change in load. Here the diaphragms, installed in the actual units in which they are to be used, are tested as to their operational characteristics—air flow, leakage, wicking, response to differential pressure, noise, and creep. A static test prescribes operation at full pressure for several hundred hours.

Anti-wicking properties, in the instance under review, were tested with particular severity. The diaphragm that posed special wicking problems had a breather hole at a distance of ¼ in. from the outer edge, connecting top and bottom chamber of the valve. The edges of the breather hole were exposed to prolonged air pressure of 100 psi. Any seepage occurring through the fabric was detected by coating the outer edges of the diaphragm with a leak test solution. Leakage and wicking, if present, are readily observed from the frothing or foaming which occurs. The fabric selected registered a wicking rate ranging from 0 to about one-fifth of that of other comparable die cut diaphragms.

Cold Box. A serious problem with diaphragms having unsuitable coating is that they stiffen in cold weather. To pass a test, diaphragm in unit must cycle satisfactorily after a minimum of five hours at —65 F in the cold box.

Oven Test. This is of particular importance for diaphragm in governors that are mounted on compressors and exposed to the engine heat. A diaphragm must cycle sat-



Protect Exhaust Systems From End to End

with Armco ALUMINIZED STEEL

New steels are born at Armco

No two areas of an auto exhaust system suffer exactly the same kind of destructive attack. In some locations, varying combinations of heat and corrosive condensate chew at exhaust system parts. Table 1 gives an idea of the destructive constituents of typical exhaust condensates. Laboratory tests indicate an average PH for similar condensates of about 2.7. In other areas, heat alone is the enemy.

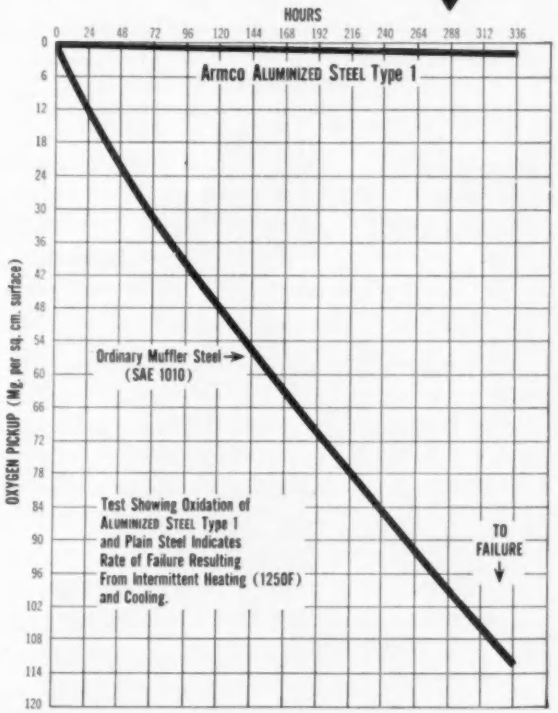
Wherever the attack, however, Armco ALUMINIZED STEEL Type 1 provides longer service life. Against deadly combinations of heat and corrosion ALUMINIZED STEEL stands up longer than any metal in its price class. Where high temperature is the major culprit, ALUMINIZED STEEL provides many times the resistance of carbon steel, as evidenced by Graph A.

In short, Armco ALUMINIZED STEEL Type 1 in exhaust system parts saves car owners money and trouble—gives auto manufacturers an important sales feature. For more information on this durable hot-dip aluminum coated steel, write Armco Steel Corporation, 2770 Curtis Street, Middletown, Ohio.

TABLE 1

AN ANALYSIS OF EXHAUST CONDENSATES

Constituent	Concentration—ppm
Sulfates (SO_4)	690
Chlorides (C1)	520
Bromides (Br)	370
Lead (Pb)	9



ARMCO STEEL

Armco Division • Sheffield Division • The National Supply Company • Armco Drainage & Metal Products, Inc. • The Armco International Corporation • Union Wire Rope Corporation

isfactorily for 600 hours at 200 F, and without showing cracks or other signs of deterioration in the coating.

Life Test. In a special life test room providing facilities for testing several hundred experimental units simultaneously, each unit must operate for at least one million cycles at maximum operating pressure. To pass the test, a unit and its individual parts, such as its diaphragm, must retain its full operating characteristics.

Road Test. Finally, when all laboratory and operating tests have been completed satisfactorily, new devices undergo extensive field tests on controlled vehicles. Efficient trucking operators who keep accurate records cooperate in these tests. To pass a field test, a unit must operate trouble free for approximately 100,000 miles on the road—a test that may take many months, and often up to two years to complete.

Only after this final hurdle has been passed by a new material, will it be specified and used in regular B-W production.

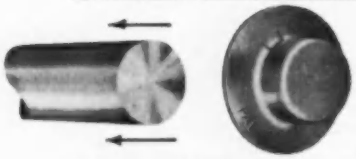
Every new shipment of diaphragm material received against established B-W specification undergoes a number of routine control tests—including adhesion tests, analysis of coating and base fabric, gauge weight—to make absolutely sure that no mistake has been made in the delivery and that the very same material is used in regular production that has been so carefully tested in the development stage. ■

Investigate this wide choice of

PUSHNUT® FASTENERS

to speed up and cut costs of Assembly

- SIMPLY PUSH ON plain rods, axles, studs or pins.
- Eliminate Tapped Nuts, Threaded Parts, Cotter Pins, Drilling Holes, Annular Grooving.
- Easy, fast assembly with manual tools or high speed air hammers.
- Tight, vibration-proof grip.



WASHER CAP TYPE

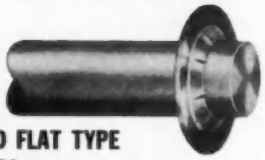
Style PW. Covers rod ends with smooth, rugged cap. Made of one-piece, heavy gauge spring steel with powerful gripping action. Always align perfectly. Various designs and finishes in sizes for 1/16", 1/4", 5/16", 3/8", 7/16" and 1/2" dia. unthreaded rod, wire and studs.



Style PC Style PK

ACORN TYPE

Pleasing, decorative appearance and strong spring grip for fastening or covering ends of rods, studs, pins, etc. Closed and open end styles. Sizes from .120" to .312" dia.



ROUND FLAT TYPE

Style PS. Low-cost, space-saving spring steel retainers push on plain rod or axle, providing strong, firm retention of parts, seated or unseated. Eliminate notching, grooving, drilling and cotter pins. Sizes for 1/16", 5/64", 1/8", 5/32", 1/4", 5/16", 3/8" and 1/2" dia. rod.

Style PV. Light duty retainer with flexible spring gripping teeth for easy assembly with fingers. For rod dia. 1/4", 5/16", 3/8" and 7/16".





ARCHED RECTANGULAR TYPE

Style PH. Push on unthreaded studs to assure tight, vibration-proof assembly of ornaments, medallions, nameplates and other parts. Grip tight on hard chrome studs. Sizes for 1/4", 5/64", 3/32", 1/8" and 5/32" dia. studs.

Write for Free Samples and Data, stating type, size and application.

PALNUT®

THE PALNUT COMPANY

DIVISION OF UNITED-CARR FASTENER CORPORATION

60 Glen Road, Mountainside, N. J.

District Office: 730 W. Eight Mile Rd., Detroit 20, Mich.

LOCK NUTS and FASTENERS

London Motor Show

(*Continued from page* 69)

in proportion to the effort. There is thus direct mechanical linkage at all times, so that hydraulic failure merely calls for greater steering effort.

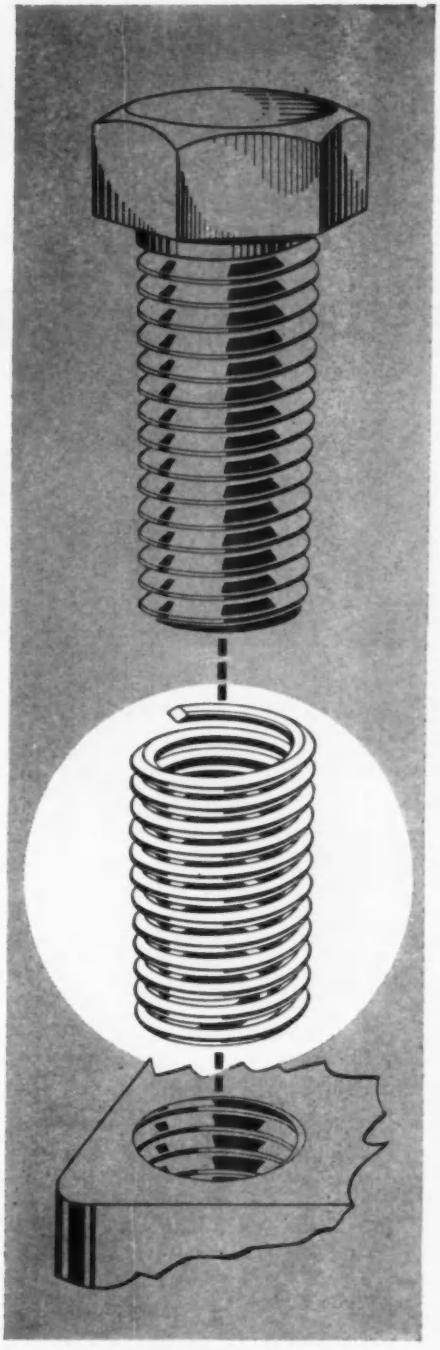
Dual headlamps for the first time on a British car were the most apparent innovation on the Humber Series III Super Snipe, unveiled at Earls Court. These are Lucas sealed-beam units of 5¾-in. diameter, designed to meet U. S. lighting regulations. The front end of the body has not only been redesigned for broader fenders, but lengthened to accommodate the air conditioning equipment that is optionally available.

Among the component manufacturers, Simms disclosed some preliminary information about its low-cost gasoline injection system designed to replace the carburetor on an ordinary multi-cylinder engine. Weighing only 3 lb and roughly a 4-in. cube, the unit differs from existing fuel injectors in having a single piston pump feeding a single nozzle centrally placed in the intake manifold.

The piston is actuated by a cam designed to inject fuel when air velocity is at maximum, and with the same number of lobes as cylinders. Lifting movement is 0.015 in.

Metering is by an eccentric shaft whose position determines the amount of closure of a relief valve and therefore the effective delivery of each pumping stroke. The mixture is regulated by a heat-sensitive element controlling air feed

For Threaded Assemblies with the STRENGTH OF STEEL in Aluminum Components



HELI-COIL® Wire SCREW THREAD Inserts

permit greater weight reduction for improved power/weight ratio, increase thread strength.

HELI-COIL Wire SCREW THREAD Inserts

provide permanent threads in all light metals to meet today's advances in automotive design and production.

HELI-COIL Wire SCREW THREAD Inserts

reduce service maintenance, save your customers expense and inconvenience from thread failure.

HELI-COIL Wire SCREW THREAD Inserts

as original equipment conform to accepted design practice . . . use standard boss dimensions and configurations. *Can even be "phased-in" as a running change on the line without any redesigning.*

Heli-Coil Inserts are cold-formed of 18-8 stainless steel wire with an exclusive diamond cross section . . . distribute stresses throughout the thread engagement. The resilient characteristic of ***Heli-Coil*** Inserts compensates for tapping imperfections, assures concentricity, prevents stripping. Wearing, galling, seizing and corroding are eliminated. Even in light metals the screws shear before the threads strip!

Specify the *Heli-Coil* Insert You Need—the ***Heli-Coil*** Standard Screw Thread Insert . . . or the ***Heli-Coil*** Screw-Lock Insert with its exclusive internal locking coil that holds the screw fast under shock and vibration; eliminates lock nuts, lock washers, lock wiring.

Heli-Coil Wire Screw Thread Inserts are original equipment on many leading cars; are recommended by FORD, GENERAL MOTORS, CHRYSLER, AMERICAN MOTORS, and other U.S. and foreign manufacturers for thread repairs in iron, steel, aluminum, and magnesium components.

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DANBURY, CONNECTICUT

Use the coupon, or write for FREE Case Histories That PROVE EVERY CLAIM!

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Please send Case Histories, Free Samples and Design Manual.

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In Canada: ARMSTRONG BEVERLEY ENGINEERING LTD.
6975 Jeanne Mance St., Montreal 15, Que.

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Performance pays off...

in automobiles and production tools



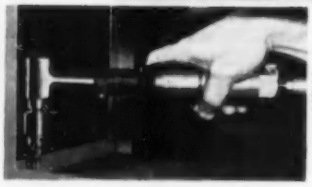
Screw Drivers



Pistol Drills



Grinders and Sanders



Right-Angle Drills

. . . and where production line performance stands out consistently you're apt to find Airetool air powered equipment. Compact and sturdy, like the new cars, Airetool pneumatic production tools are engineered to deliver top-notch, 'round-the-clock production with little maintenance.

For the complete story on how Airetool can bolster your production line performance write:

AIRETOOL
MANUFACTURING COMPANY
SPRINGFIELD, OHIO

30 years experience in pneumatic tools

Branch Offices: New York, Chicago, Tulsa, Philadelphia, Houston, Baton Rouge
Representatives in principal cities of U.S.A., Canada, Mexico, South America, England, Europe, Puerto Rico, Italy, Japan, Hawaii
European Plant: Vlaardingen, The Netherlands
Canadian Plant: Brantford, Ontario

Circle 159 on Inquiry Card for more data

during starting and warm-up.

Simms has fitted the unit to a Ford Consul, and claims that 0-to-70 mph acceleration is improved by nearly 25 per cent, top speed raised from 80 to 85 mph, and fuel consumption reduced by an average of some 6 per cent. ■

Selecting Proper Cutting Fluids

(*Continued from page* 78)

of the available material and knowledge.

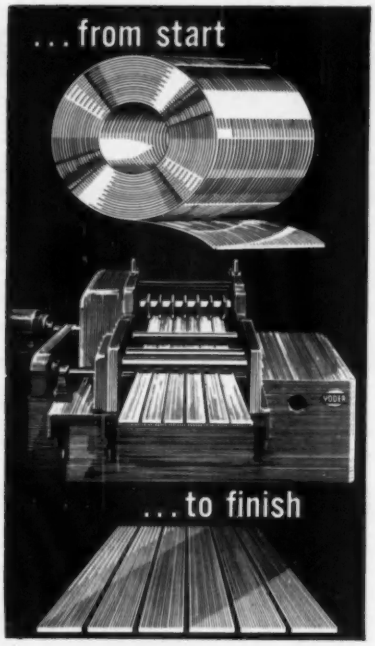
Assuming there is agreement that both projects must be accomplished, the entire job could be done quite readily by just two special committees. What would this accomplish for industry? In the first place, the recommendation chart will make it easier for the supplier and the user to get together. You start with a generalized specification. This leads logically to a plant evaluation project and, ultimately ends up with a very specific brand name material that can handle the operation most effectively. In a sense, an official chart lays the groundwork for better acceptance of a new product, removes some of the mysticism associated with snake oil.

Important By-Products

There are many other important by-products. For example, when authenticated data are presented to the management of a plant, they can begin to appreciate the virtue of simplification. Many plants use too many different kinds and makes of cutting fluids for essentially the same kind of task. There is enormous economy to a plant in reducing the number of basic cutting fluids to a minimum. It becomes easier to handle and dispense; there is less margin of error in applications; and inventory cost can be held to a minimum. These are important considerations in a large metalworking plant.

This matter of simplification, the use of the very minimum number of cutting fluids or oils or bases is of vital importance to industry and to those producing for

(*Turn to page* 122, *please*)



YODER ROTARY SLITTERS

If your slitting requirements call for coil widths from 12" to 60", in gauges from .015" to .250", the economy of purchasing Yoder Slitting Machinery can be yours. Operating a Yoder Slitting Line only one eight-hour shift per week, for example, could easily produce 35 tons of slit strands per week . . . or 1,820 tons every 52 weeks. At a slitting cost saving of only ½¢ per pound, the annual savings would amount to $18,200.

Additional savings can be realized through lowered inventory of mill-width coils — less waiting for delivery of special slit widths. Also, customer satisfaction will increase as you achieve faster completion and delivery of finished products.

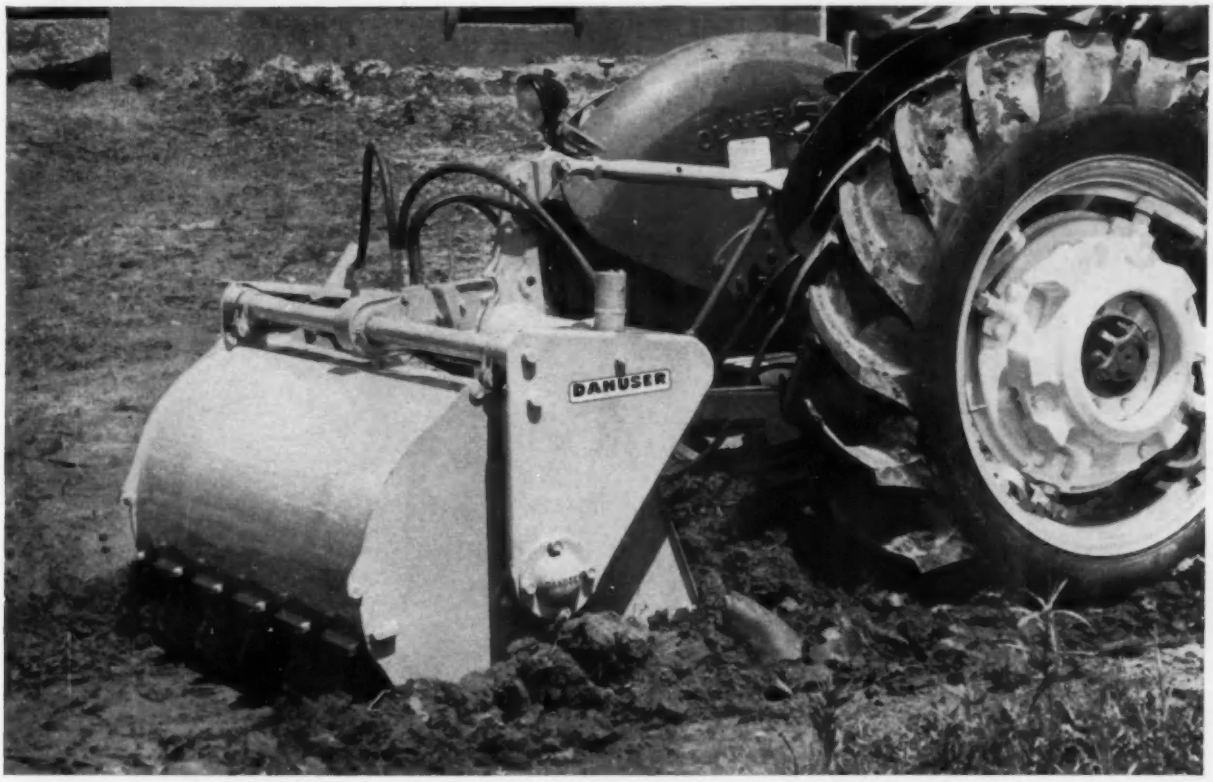
At your request a Yoder sales engineer will study your plant operation to determine what equipment would most economically . . . and profitably . . . serve you, whether it be standard components or a completely specialized and engineered line.

Send for Yoder's illustrated text on slitting operations and equipment. It describes methods, time studies, operating cycles, material handling, and gives full specifications.

THE YODER COMPANY
5553 Walworth Avenue • Cleveland 2, Ohio

ENGINEERING YODER MANUFACTURING
ROTARY SLITTING LINES

Circle 160 on Inquiry Card for more data



The versatile Terra Scoop, designed for maximum strength with minimum dead weight. Built by Danuser Machine Company, Fulton, Mo. Weighs only 540 pounds. USS "T-1" Steel is readily flame cut, welded and fabricated by usual shop methods.

Lightweight scoop built **strong and rigid** with USS "T-1" Steel

The big problem in designing the "Terra Scoop," a bucket with over ½-yard capacity for small tractors, was to obtain great strength and rigidity without exceeding size and weight limitations.

The first prototype scoop bulged at the ends and couldn't be used. That's where USS "T-1" Steel entered the picture. With a minimum yield strength of 100,000 psi, ¼-inch plates of "T-1" Steel gave the Terra Scoop all the strength it needed—and more, too—without increasing weight.

Since then, many Terra Scoops have been sold. *Not a single failure has been recorded in any of the end plates*—thanks to the extra yield strength of USS "T-1" Steel. What's more, the high resistance of "T-1" Steel to impact abrasion and corrosion has added years to scoop life.

Fabrication advantages. During initial testing, it was established that flame cutting, by which the end plate is made, actually imparts a superior hardness to the edge which functions as a cam in the operating mechanism. This edge has to retain its hardness to prevent peening from hardened rollers with which it comes in contact. Welding and machining were accomplished without difficulty using recommended shop methods.

Free books for designers. If your problem is designing bigger, more rugged equipment, you'll be interested in our booklets on USS "T-1" Constructional Alloy Steel and USS MAN-TEN, COR-TEN and TRI-TEN Brands of High Strength Steel. Write United States Steel, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

USS, "T-1", MAN-TEN, COR-TEN and TRI-TEN are registered trademarks

This mark tells you a product is made of modern, dependable Steel.

United States Steel Corporation—Pittsburgh
Columbia-Geneva Steel—San Francisco
Tennessee Coal & Iron—Fairfield, Alabama
United States Steel Supply—Steel Service Centers
United States Steel Export Company
United States Steel

He's looking for tomorrow's headlamp



The purpose of this scientific analysis is to develop more efficient headlighting for the cars of tomorrow . . . headlighting that will meet the exacting, yet divergent demands of higher speed turnpikes and heavier in-city traffic.

Here Tung-Sol research and development engineers compare the headlamp beam pattern produced by a newly designed sample lens (right) with that of a standard production model by the use of special aiming heads under laboratory conditions.

This continuing project is an example of the research and development that keeps Tung-Sol to the fore in the quality mass production of headlamps. It is historical fact, too, that Tung-Sol has made significant contributions to major headlighting improvements since the turn of the century when it produced the first successful electric headlamp. Automotive Products Division, Tung-Sol Electric Inc., Newark 4, N. J. TWX: NK193.



TUNG-SOL® HEADLAMPS • MINIATURE LAMPS • FLASHERS

OHIO RUBBER

"CUSTOMEERED COMPONENTS BASIC TO INDUSTRY"



STAINLESS STEEL JEWELS
make facsimiles by the million!

OHIO RUBBER can, and regularly does produce 100,000 *identical* rubber parts per day from one set of production tooling. The jewel-like precision of the self registering molds shown above—actual size—is a key factor in ORCO's high speed, high accuracy, continuous molding process.

AUTOMATIC INTEGRATION of processing steps which are usually handled separately eliminates variables—provides precise control for achieving the ultimate in product uniformity. RUBBER PARTS up to 1½" in diameter and 1" in thickness produced by this process are distinguished by uniformity, minimum flash and precision tolerance of ± .003".

QUANTITY REQUIREMENTS involving not less than 500,000 parts proves best for this new process.

"**DO YOU** use small precision molded rubber parts by the million?", if so, the full story of ORCO "CUSTOMEERED" Continuous Molding is yours via free Bulletin CM-100. Send for your copy today to see how custom molded, precision rubber parts can be produced in volume—at less cost. MP-160

ORCO

THE OHIO RUBBER COMPANY

General Office • WILLOUGHBY, OHIO • WHitehall 2-0500

A DIVISION OF THE EAGLE PICHER COMPANY

WANT "ON-SCHEDULE" HOSE CLAMP DELIVERIES?



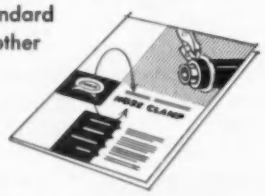
You can count on CORBIN!

Corbin has the capacity to produce hose clamps well in advance of your needs. By a planned program of stock-building, Corbin assures you of consistently on-schedule deliveries — plus reserve stocks for emergencies. For *dependable* hose clamp supply — by the carton or the carload — count on Corbin . . . makers of the original self-tightening hose clamp, the world's leading hose clamp supplier!

. . . and you get all this from CORBIN, too!

- ✓ **PROVEN PERFORMANCE** — Used by many leading manufacturers since first introduced
- ✓ **VOLUME SUPPLY** — Corbin is the world's leading hose clamp supplier — the *safe* source for volume users
- ✓ **SCHEDULED DELIVERIES** — Shipments systematically geared to your production schedule
- ✓ **RESERVE STOCKS** — Emergency needs are promptly met from continuously maintained reserves
- ✓ **ALL SIZES** — More standard maker sizes than any other

Write for Fact Folder HC20 and Size Specification Sheet



CORBIN

CORBIN HOSE CLAMP DIVISION
THE AMERICAN HARDWARE CORPORATION
NEW BRITAIN, CONNECTICUT



ON OUR WASHINGTON WIRE

The number of motor vehicles on U. S. highways will reach 73,868,000 by the end of the year, a 3.3 per cent increase over 1959, according to the Department of Commerce. Passenger car registration will total more than 61.5 million.

The Air Force will conduct a sizeable test of anti-smog devices—as a byproduct of its search for fuel economy for its ground vehicles. After a preliminary test, the Air Force is buying 2000 "blowby" devices for testing fuel savings from re-burning crankcase gases. Since completeness of combustion is a major factor in smog control, it will also add some figures to studies of this problem.

The National Aeronautics and Space Administration has set up a special division to oversee development of materials for space program, The division was set up in recognition of the importance of materials research in space flight programs.

The government is pushing increased investment and tourism in Mexico to offset stepped up Communist activity there. Deeply concerned about the Mexican situation, the State Department is preaching more American spending in Mexico while fearing to talk about the danger in public. Officials believe there is no danger of losing Mexico to the Reds if plans to increase investment work.

Space spending will build up to about $2 billion a year by 1965 and then will level off. This is the view of Dr. Homer Joe Stewart, one of the world's foremost space experts. He has been director of Program Planning and Evaluation for the National Aeronautics and Space Administration.

Defense contracts for sea-launched satellites are in the offing. The Navy plans to go ahead with its program to set up ships as mobile launching platforms. Adm. John T. Hayward, Deputy Chief of Naval Operations for Development, says the Navy is "pursuing the program avidly." Sea-launch satellites are valuable because they can be put into any desired orbit.

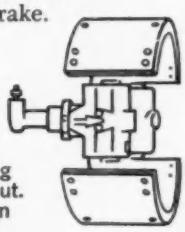
Government trust busters are stepping up their crackdown on "rigged" bidding on government contracts. Robert A. Bicks, head of the Justice Department's Antitrust Div., is enlisting state aid in finding and prosecuting cases of identical bidding.

The military surplus property sales program will be completely changed by the first of the year. The Defense Department is revamping sales procedure to simplify buying, especially for small businesses. The new program will use a short form application for prospective buyers. It will centralize military sales and will simplify bidding methods.

ACTUAL TESTS PROVE:

NEW STOPMASTER BRAKE IS the most advanced brake design in 30 years!

Over three years of thorough and demanding road tests have proven the superiority of the new Rockwell-Standard Stopmaster Brake. Of its many new improvements the Stopmaster incorporates these major advantages to meet the modern trucking industry's demand for a more efficient, more dependable brake.

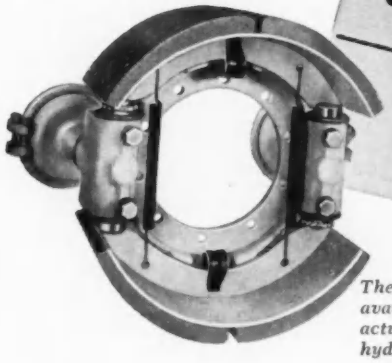


New Stopmaster actuation principal results in higher braking efficiency with less input. In dual actuation design both shoes do an equal amount of work over the entire lining surface. This balanced shoe action assures more dependable service; faster, surer stops; less maintenance.

New Stopmaster 15" diameter permits increased air circulation between brake drum and wheel rim. This results in cooler operating temperatures . . . less heat fade, longer lining life, longer drum life. Smaller diameter means less weight.

AVERAGE RESULTS OF NUMEROUS HIGHWAY VEHICLE TESTS PROVE:

- **35% lighter weight..** more payload capacity!
- **38% less heat fade..** safer, more continuous operation!
- **57% less air volume required..** permits smaller air reservoir tanks!
- **56% longer lining life..** lower operating cost, less maintenance!
- **56% longer drum life..** more dependability, less downtime!
- **66% less adjustment required..** greater safety, reduced maintenance!
- **37% less service parts** smaller inventories, less expensive!



The Stopmaster 15" Brake is available with either air or hydraulic actuation . . . also up to 30" diameter, with hydraulic actuation for heavy-duty, off-highway vehicles.

Another Product of...

ROCKWELL-STANDARD CORPORATION

ROCKWELL R STANDARD

Brake Division, Ashtabula, Ohio

Circle 164 on Inquiry Card for more data

More Government Contract Awards

LATEST contracts awarded by various Government agencies, and covering primarily automotive and aviation products, are listed in the following. Typical of the items contained in these monthly listings are: passenger cars, motor trucks, aircraft, military tanks, engines, transmissions, other components, spare parts, plant equipment, etc. This list is for the period Aug. 30 to Oct. 26 inclusive.

AIRBORNE ACCESSORIES CORP., Hillside, N. J.
Spare parts, various aircraft, 25 to 1060 ea—$308,233

ARMSTRONG RUBBER CO., West Haven, Conn.
Tires, 48,431 ea—$999,833

AUTOMATIC TRANSPORTATION CO., DIV. OF YALE & TOWNE MFG. CO., Chicago, Ill.
Tractor, wheeled, 9 ea—$34,149

BENDIX AVIATION CORP., Bendix Products Div., South Bend, Ind.
Spare parts, 5 to 1000 ea—$124,923

THE BENDIX CORP., SCINTILLA DIV., Sidney, N. Y.
Spare parts, various aircraft engines, 10 to 6100 ea—$177,869

BURG TOOL MFG. CO., INC., Gardena, Calif.
Drilling machine, 1 ea—$45,853

CHRYSLER MOTORS CORP., Washington, D. C.
Trucks, 16 ea—$62,102

CLARK EQUIPMENT CO., Battle Creek, Mich.
Truck, pallet, elec. powered, 27 ea—$31,511

CUTLER-HAMMER, INC., Seattle, Wash.
Motor Control Equipment, 9 sets—$32,025

W. D. DARLEY & CO., Washington, D. C.
Trucks, 1 ea—$14,266

DEN-AIR OF NEW YORK, INC., Montclair, N. J.
Aircraft tires, 721 ea—$115,360

DOUGLAS AIRCRAFT CO., INC., Santa Monica, Calif.
Components, spare parts for air-to-air rockets—$600,000

THE J. H. ELLIOTT CO., Washington, D. C.
Punch press, 1 ea—$209,950

FIRESTONE TIRE & RUBBER CO., DEFENSE PRODUCTS DIV., Akron, Ohio
Tires, 7-831 ea—$2,650,175

FIRESTONE TIRE & RUBBER CO., DEFENSE PRODUCTS DIV., Akron, Ohio
Tires, pneumatic aircraft, 4,388 ea—$278,573

FISK TIRES DIV., U. S. RUBBER CO., Detroit, Mich.
Tube, 29,372 ea—$69,611

FORD MOTOR CO., FORD DIV., Washington, D. C.
Trucks, 11 ea—$25,320

FORD MOTOR CO., GOVERNMENT SALES DEPT., Washington, D. C.
Sedans, 5 ea—$14,902

FORD MOTOR CO., GOVERNMENT SALES DEPT., Washington, D. C.
Trucks, 6 ea—$21,343

FRUEHAUF TRAILER CO., MILITARY EQUIPMENT & MISSILE PRODUCTS DIV., Detroit, Mich.
Various types of ground support equipment—$2,500,000

GENERAL ELECTRIC CO., Lynn, Mass.
Jet engine—$32,500,000

GENERAL ELECTRIC CO., ROCKET ENGINE SECTION, Cincinnati, Ohio
Research and development—$1,000,000

GENERAL MOTORS CORP., AC SPARK PLUG DIV., Flint, Mich.
Spark plugs, aircraft engines, 58,500 ea—$229,905

GENERAL MOTORS CORP., ALLISON DIV., Indianapolis, Ind.
Aircraft engines—$25,153,000

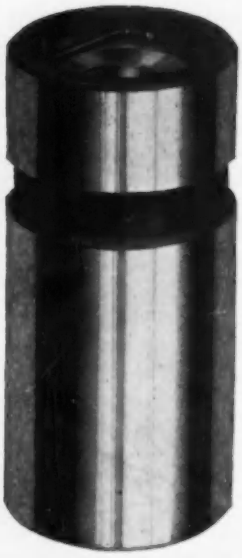
GENERAL MOTORS CORP., CHEVOLET MOTOR DIV., Detroit, Mich.
Trucks, various, 46 ea—$116,283

GENERAL MOTORS CORP., DELCO PRODUCTS DIV., Dayton, Ohio
Spare parts, various aircraft, 10 to 31,000 ea—$33,003

GENERAL TIRE & RUBBER CO., Akron, Ohio
Tires, pneumatic, 35,992 ea—$2,599,996

B. F. GOODRICH AVIATION PRODUCTS, DIV. OF B. F. GOODRICH CO., Akron, Ohio
Tires, 11,629 ea—$912,042

(*Turn to page* 120, *please*)



for all engine applications

JOHNSON *tappets*

Keeping ahead with the latest tappet developments is a full-time job at JOHNSON PRODUCTS. All of our design engineering and manufacturing improvements go toward giving your engine the right kind of *tappet performance.*

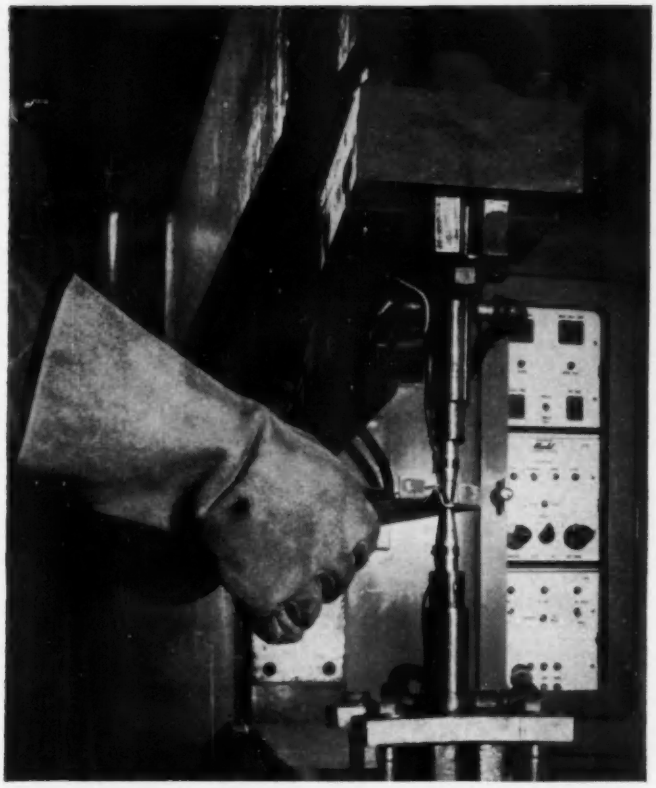
We think the results speak for themselves: Johnson Tappets are *high in quality, competitive in price.* As tappet specialists, we welcome the opportunity to show you how well the job can be done.

Johnson TAPPETS

"tappets are our business"

JOHNSON JP PRODUCTS
MUSKEGON, inc. MICHIGAN

NEW FEEDBACK CONTROL
makes every weld count



Information from electrodes is fed back to **Monautronic V-2** in background. Control has fully automatic sequencing with all provisions for single spot, roll spot and seam welding.

Now, with the new **Monautronic V-2** welding control, you can make consistently top-quality welds over long stretches of time, without stopping to test and inspect sample welds. The control senses variations in line voltage, electrode shape and tip force, material thickness and surface finish . . . and compensates for them immediately.

The **Monautronic V-2** automatically compares actual voltage across the weld with command voltage, and adjusts current accordingly to maintain voltage—and weld quality—at a constant level. If weld resistance is too high or too low to produce a good weld, the control locks out until the condition is corrected.

Although the **Monautronic V-2** embodies the latest advances in computer-type circuitry, it is quite simple to operate, and easier to maintain than most conventional controls. For complete details, contact THE BUDD COMPANY, Electronic Controls Section, Philadelphia 32, Pa., or one of our regional offices.



Here's a typical example of how **Monautronic** Welding Controls pay off. The part at the left is fastened by butt welding a piece of square cut mill bar stock to the side of a section of thick-walled tubular stock. With conventional control, 100% inspection at 8000 pounds pull revealed that approximately 5% of the assemblies ended up in the scrap pile. With **Monautronic** Controls, failures were cut to less than ¼ of 1%. The few times failures did occur, the **Monautronic** Control locked out automatically indicating a low quality weld. The piece at the left failed at 14,000 pounds. Notice that the nugget is almost as large in diameter as the bar stock.

2450 Hunting Park Ave.
Philadelphia 32, Pa.

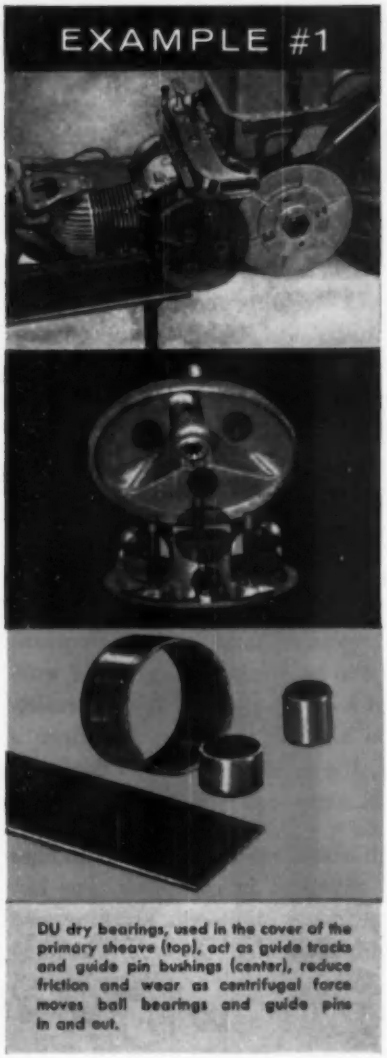
1515 N. Harlem Ave.
Oak Park, Ill.

12141 Charlevoix Ave.
Detroit 14, Mich.

3050 East 11th St.
Los Angeles 23, Cal.

ELECTRONIC Budd CONTROLS

Circle 166 on Inquiry Card for more data



DU dry bearings, used in the cover of the primary sheave (top), act as guide tracks and guide pin bushings (center), reduce friction and wear as centrifugal force moves ball bearings and guide pins in and out.

NEW GLACIER DU* DRY BEARINGS

greatly improve transmission design of Harley-Davidson "Topper"

Used at vital locations in the transmission assembly, DU dry bearings reduce friction and wear to the absolute minimum on the latest addition to Harley-Davidson's fine motor scooter line. DU dry bearings solve another problem, too—the accumulation of dirt and grime in the transmission lubrication. DU material requires no lubrication whatsoever, and will last many times longer than other dry bearings.

DU metal is an ideal bearing material. It withstands much higher velocities, runs much cooler at lower speeds than other unlubricated bearings . . . has a compressive strength of 51,000 p.s.i. DU metal is applied without the need for temperature-limiting adhesives . . . will withstand from −328°F to +536°F.

Apply DU material to appliances, automobiles, aircraft, farm and industrial machinery, office equipment. Standard bushings and thrust washers stocked for 3/8″ to 2″ shafts; strip available for special fabrication. Find out more from your bearing manufacturer, or write for engineering catalog DU-458. **Special Products Dept.**, United States Gasket Company, Plastics Division of Garlock Inc., Camden 1, New Jersey.

GARLOCK

*Trademark, Glacier Metal Company Ltd.

Gov't Contract Awards

(*Continued from page* 118)

B. F. GOODRICH AVIATION PRODUCTS, A DIV. OF THE B. F. GOODRICH CO., Akron, Ohio
Tires, pneumatic aircraft, 15,830 ea—$2,577,664

GOODYEAR TIRE & RUBBER CO., Akron, Ohio
Tires, 22,026 ea—$2,847,234

GOODYEAR TIRE & RUBBER CO., Akron, Ohio
Tires, pneumatic aircraft, 10,680 ea—$961,230

GOULD-NATIONAL BATTERIES, INC., St. Paul, Minn.
Battery, 6 volt, 3055 ea—$38,852

GRAY MARINE MOTOR CO., Detroit, Mich.
Engines, Diesel, 30 ea—$57,288

THE HEALD MACHINE CO., Worcester, Mass.
Drilling machine, 1 ea—$49,853

INTERNATIONAL HARVESTER CO., Washington, D. C.
Trucks, 16 ea—$47,378

KEARNEY & TRECKER CORP., Milwaukee, Wis.
Milling machine, 1 ea—$40,510

EDWARD A. LYNCH MACHINERY CO., INC., Wynnewood, Pa.
Squaring shears, hydraulic, 1 ea—$36,850

NORTHWESTER MOTOR CO., Eau Claire, Wis.
Tractor, wheeled, 277 ea—$623,669

PRATT & WHITNEY CO., INC., West Hartford, Conn.
Tap, thread cutting, 51,540 ea—$35,235

FRANK G. SCHENUIT RUBBER CO., Baltimore, Md.
Tires, pneumatic, 20,537 ea—$1,966,170

FRANK G. SCHENUIT RUBBER CO., Baltimore, Md.
Tires, pneumatic aircraft, 1826 ea—$140,905

W. E. SHIPLEY MACHINERY CO., Phila., Pa.
Grinder, surface, 1 ea—$40,000

W. E. SHIPLEY MACHINERY CO., Phila., Pa.
Lathe, engine 4 ea—$60,316

STANDARD MFG. CO., INC., Dallas, Tex.
Truck, Van, 55 ea—$540,679

STUDEBAKER-PACKARD CORP., South Bend, Ind.
Trucks, 4 ea—$10,932

STUDEBAKER-PACKARD CORP., South Bend, Ind.
7 ea. and 1 displacement engine—$12,851

TRANSITIER TRUCK CO., Portland, Ore.
Liftfork, 1 ea—$76,000

UNITED STATES RUBBER CO., Detroit, Mich.
Tires, 18,654 ea—$2,496,911

UNITED STATES RUBBER CO., Detroit, Mich.
Tires, pneumatic aircraft, 11,906 ea—$825,353

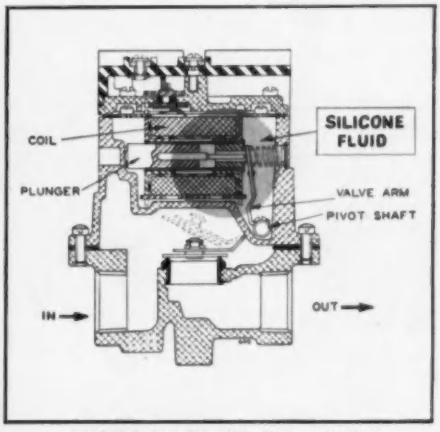
WATSON AUTOMOTIVE EQUIPMENT CO., Arlington, Va.
Ambulance, 1 ea—$8,141

WILLYS MOTORS, INC., Toledo, Ohio
Trucks, 127 ea—$302,984

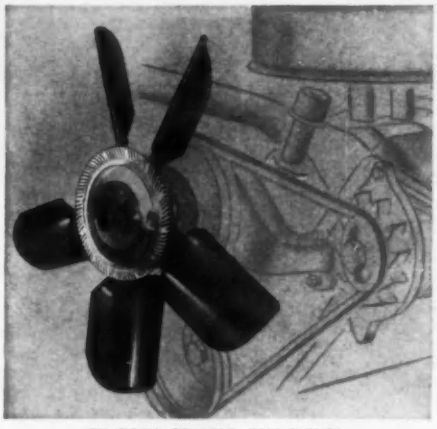
SILICONE NEWS from Dow Corning

For Designs That Perform





SILICONE DAMPED CONTROL VALVES



SILICONE COUPLED FAN DRIVES

New Fluids Assure Accuracy

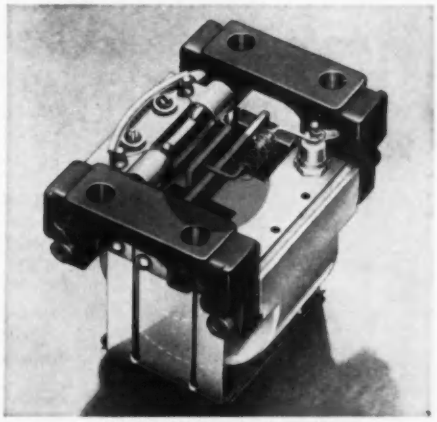
Here's why Dow Corning silicone fluids improve performance of mechano-fluid devices and controls. They maintain near-constant viscosity over a wide temperature span; exceptional resistance to oxidation and to breakdown due to shear; and fine dielectric properties. In service, these silicone liquids don't sludge or gum; don't corrode metals nor cause rubber to swell.

Uniform Damping From the arctic to the tropics, behavior of Dow Corning silicone fluids remains virtually constant. As indicated by performance in a torsional vibration damper, damping effect of silicone fluid decreases in the ratio of 3 to 1 over a temperature range from —40 to 160 F; a petroleum hydraulic fluid decreases in the ratio of 2500 to 1.

Damping Medium	Pounds of Damping Force Required to Actuate Against Viscous Drag	
	at —40 F	at 160 F
Dow Corning 200 Fluid 30,000 centistoke grade	210	70
Petroleum Hydraulic Oil (Very high viscosity)	70	0.028

Compressibility Too Formulated to retain its desirable characteristics and also have good compressibility at high pressures, a silicone fluid for "liquid springs" for aircraft landing wheels makes possible a 30% smaller oil chamber; assures uniform performance over wide temperature range.

Aid to Miniaturization The near-ideal silicone fluids also help to reduce size and weight of accelerometers, fan drives, radar buffers, differential pressure cell transmitters, panel instruments and truck scales.



SILICONE DAMPED ACCELEROMETERS

For more information about silicones and their use in automotive design and production, contact the Dow Corning office nearest you, or write Department 0911.

first in silicones

Dow Corning CORPORATION
MIDLAND, MICHIGAN

ATLANTA BOSTON CHICAGO CLEVELAND DALLAS LOS ANGELES NEW YORK WASHINGTON, D. C.

Circle 168 on Inquiry Card for more data

Selecting Proper Cutting Fluids

(*Continued from page* 112)

the military establishment. As a matter of fact, those in AOA could profit by one of the management features of the Ford setup. For example, in the engine manufacturing group the practice is to survey the various plants and indicate on a form the kind of cutting fluid employed on the machining of specific parts, common to all engines. This shows up immediately the variations in practice, and makes it feasible to make practice more uniform.

Uniform Practice

Similarly, it should be possible to survey plants making similar military material or similar components to seek out variations in practice. Then an AOA committee group could study the problem more closely and doubtless come up with more uniform practice that would benefit the manufacturers, the customer, and the taxpayer.

In time if simplification of cutting fluids usage is effected over a wide area of industry, it would result in important economies for the suppliers as well. Refiners could reduce the number of formulations without losing competitive advantage. And their own operation can be simplified and rendered more economical by eliminating special items. It would add up to a smaller number of catalog items to produce and blend, store and distribute. Surely most refiners would welcome this prospect.

Reap Real Benefits

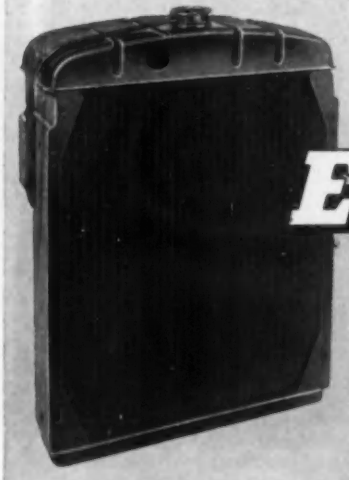
Another thing to bear in mind is that only the larger metalworking plants can afford a staff of chemists and metallurgists and process study engineers. Such plants are competent to make their own investigations and write specifications stemming from them. But how about the thousands of smaller plants that do not have chemists and ofttimes do not have a metallurgist on the payroll? These plants can reap real benefit from this procedure.

Despite the march of progress, there is little opportunity for formal shop evaluation on some rational basis. A change or an improvement or a new product should have an opportunity for testing in a specific machine on the floor of the plant. After all, that is the only way a new product can be evaluated. This appears to be another forgotten area. Here too there should be a group to study shop evaluation and come up with a standardized procedure that would have the weight of authority and acceptance by the user.

Conclusion

Cutting fluids utilization has become exceedingly complex. We have many examples of centralized fluid systems, serving individual departments or lines of transfer machines. There are questions of filtration, refrigeration, salvage and rectification of fluids. These problems are intermingled with the many variables associated with metal cutting: the effect of machinability on tool materials and tool forms; machine design and

FOR DEPENDABLE All Weather COOLING



Install EUREKA RADIATORS

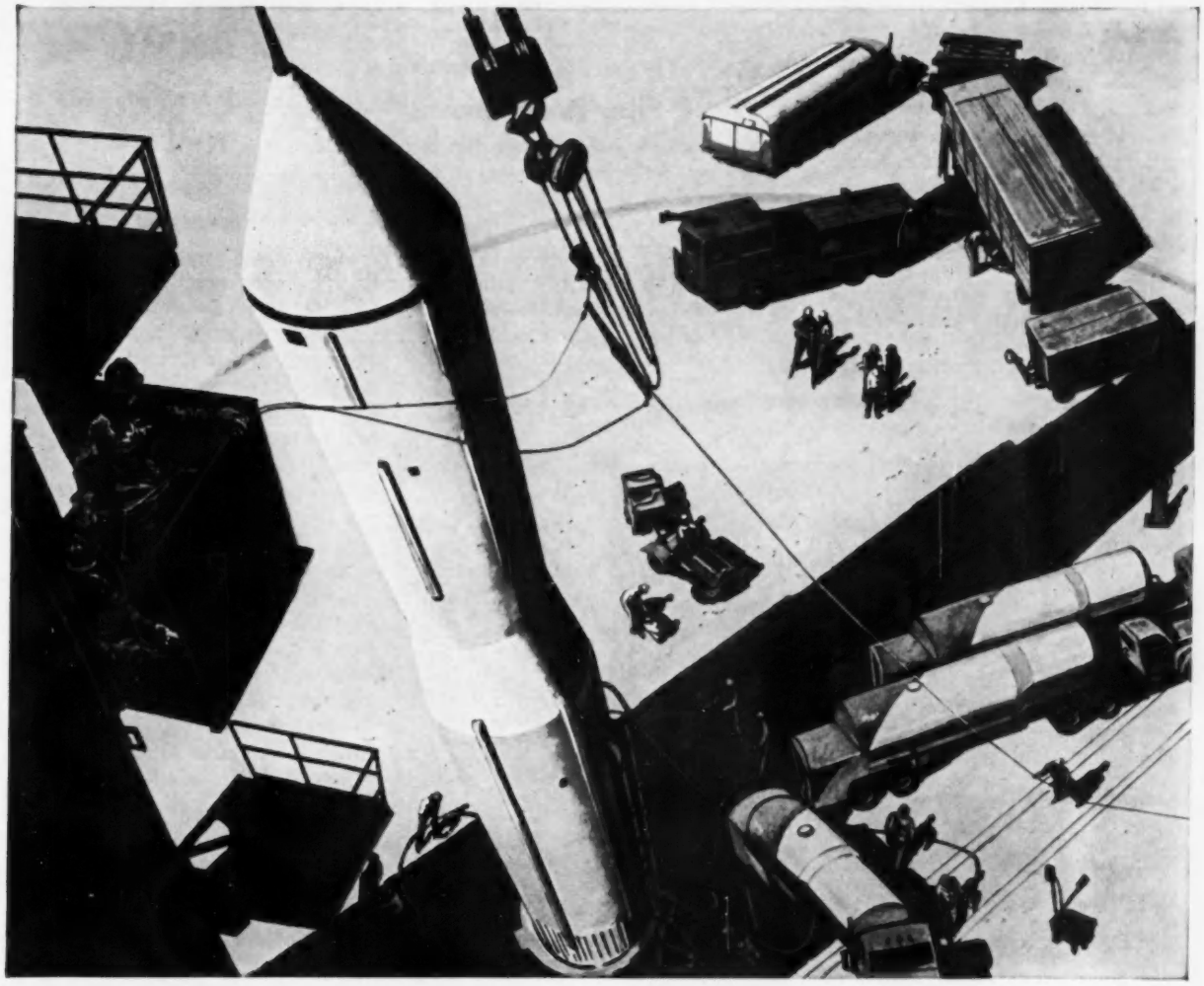
Over 30 years of specialization and engineering research have produced a radiator and core proved dependable under all conditions.

We Invite INQUIRIES ON Complete Radiators FOR ALL INDUSTRIAL APPLICATIONS

- ALL-COPPER CORES and TUBES double-lock seamed give greater strength and eliminate danger of rusting
- 1-piece upper-and-lower-tank brass stampings for POSITIVE PROTECTION FROM LEAKAGE AND VIBRATION . . .
- Large tube area for EFFICIENT COOLING IN ALL WEATHER, all driving conditions . . .
- GUARANTEED against defects in materials and workmanship.

WRITE TODAY FOR DETAILS

EUREKA AUTO RADIATOR Manufacturing Co.
2901-17 INDIANA AVE. • CHICAGO 16, ILLINOIS

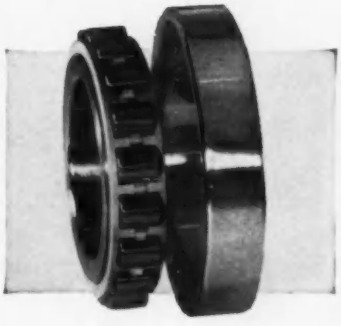


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When a rocket fires, each component must *be* right, *work* right, the *first* time—and operating conditions are extreme! For example, liquid oxygen sends bearing temperatures plunging to hundreds of degrees below zero . . . while engine heat roasts bearings at a near-thousand degrees. Elsewhere, incredibly precise systems move surely on bearings with millionths-of-an-inch tolerances. In these critical applications you'll find Bower Roller Bearings!

On the ground, Bower Roller Bearings keep trucks, equipment and gantries rolling under the heavy loads essential to the missile's launching.

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machine condition; application of cutting fluids; checking of mixtures, etc.

Combinations of these and other variables have a large effect upon the kind of cutting fluid that works best. If we can provide the user with authentic data, data in which he has confidence, that should make the job of the applications engineer the more bearable. ■

The foregoing is from a paper presented by the author at the 17th Meeting of the Metalworking Lubricants Section of A.O.A., October 27, 1960, at the Arnold Engineering Center, Tullahoma, Tenn.

Gray Iron Founders Have Film Premiere

A 30-minute movie, "Rice Bowls to Rockets," the story of gray iron castings, has been given its first showing by the Gray Iron Founders' Society in Cincinnati, O.

Directed to users of castings, it is the first of a nine-film package being produced by the society.



Lamb Electric works in so many fields—where motors that have vastly different jobs to do are sold to vastly different markets — that experience gained in one field often helps solve problems in other fields.

For example, we are able to incorporate in motors for appliances, portable electric tools, and similar products, developments that came about in research and engineering work on military and other precision motors.

This broad experience—available to all of our customers—is one way in which Lamb Electric special application motors can help your product stay ahead of competition.

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In Canada: Lamb Electric Division of Sangamo Company Ltd.—Leaside, Ontario

Aeronautics Meeting of the SAE

(*Continued from page* 96)

New Manufacturing Techniques

Processing

How to save weight in the flying article determines the choice of the process. Cost is secondary.

Today's demands for better performance in our aircraft and missiles are creating new materials and processing problems. These are made more challenging by the need for high strength materials to give a lightweight structure. So it's the importance of weight saving that determines the processing rather than cost alone.

Example: If the structure of a 7000-lb missile is overweight by only one pound, its maximum range is cut by one mile. And to take the extreme, if the missile structure were made from low strength, easy-to-fabricate materials, the range would be cut in half.

Ablative materials have a variety of uses on missile structures. Chiefly, they give thermal protection of standard substructure materials and short term expandable high temperature hardware. But they're also used for flight structure, flight antennas, and exterior guidance packages. Rocket nozzles and heat deflectors are typical expandable structures made from these materials.

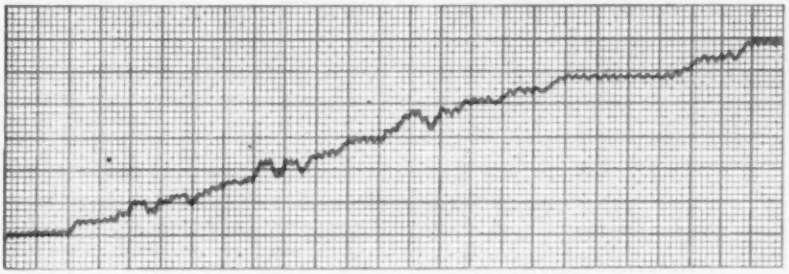
The very nature of these materials creates manufacturing problems. The manufacturing process does more than change a shape. It changes the chemical formation to a new molecular structure. So we need closer control of processing parameters.

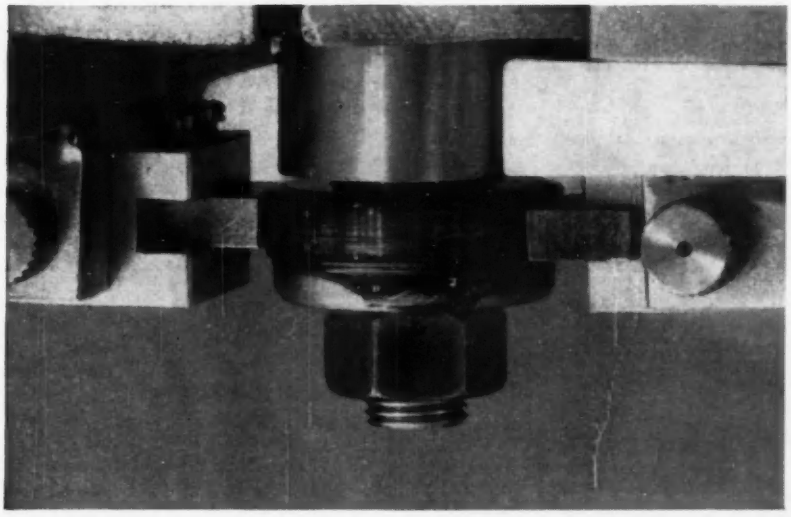
To compensate for raw material and environmental variation, we need to make constant in-process adjustments. We must place heavy emphasis in the future on operator skill and versatility.

Refractory Metals

Coating of refractory metals drew plenty of interest. Aerodynamic heating may raise external surface operating temperatures for

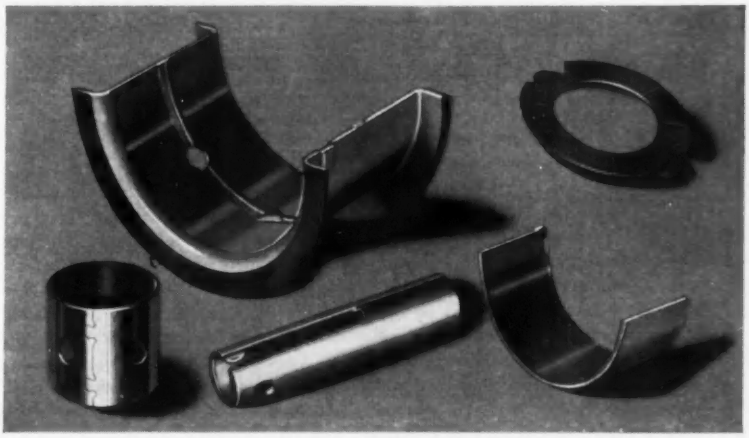
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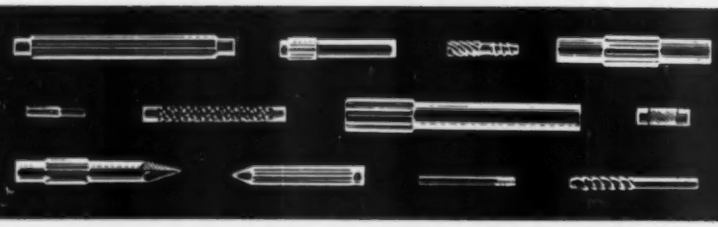
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future aerospace vehicles to 3000 F for short periods. This points to use of refractory metals with their strength properties at high temperatures.

Major use problem with refractory metals or graphite is oxidation. Most metal oxides provide protection to the base metal beyond the base metal service temperature. This is typical of aluminum, nickel, and chromium.

However, with molybdenum, columbium, or graphite, this doesn't hold. Molybdenum oxide is volatile at temperatures above 1200 to 1300 F. With columbium the oxide undergoes auto-ignition (self-sustained burning) at temperatures above 2500 F.

Graphite, of course, oxidizes in air at elevated temperatures. Alloying of the base metal and coatings applied to the base metal or non-metal are being studied to decrease or control air oxidation.

Reliability

Just what is the overall reliability job that has to be done?

Dr. Leslie W. Ball, director of reliability, Boeing Airplane Company's Aero-Space Division, sees it this way.

It's a job for design, purchasing, manufacturing, and quality personnel. They must do two things: (1) Identify causes of failure in terms of controllable employe errors and (2) Set up a coordinated program of recurrence control disciplines.

Here are the points Dr. Ball thinks we should keep in mind:

(1) Traditional practices, particularly process control and qualification testing, were established to deal with failures that have a probability of occurrence.

(2) The additional techniques required by a reliability program must deal with infrequently occurring modes of failure.

(3) The underlying cause of infrequently occuring modes of failure is continuous or discrete variation in the strength of the manufactured product.

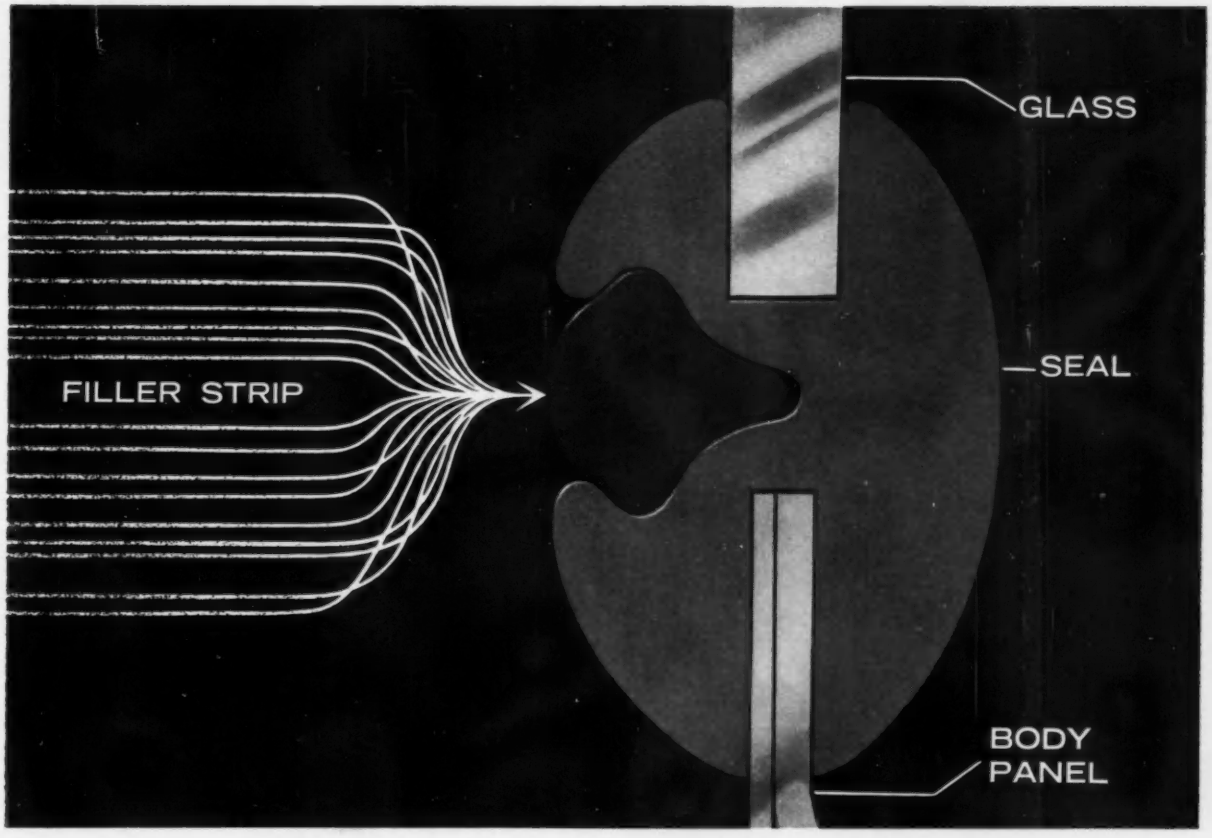
(4) Technologies for controlling manufacturing and inspection to produce high reliability result from failure analyses.

(5) To be effective, reliability

(*Turn to page* 130, *please*)

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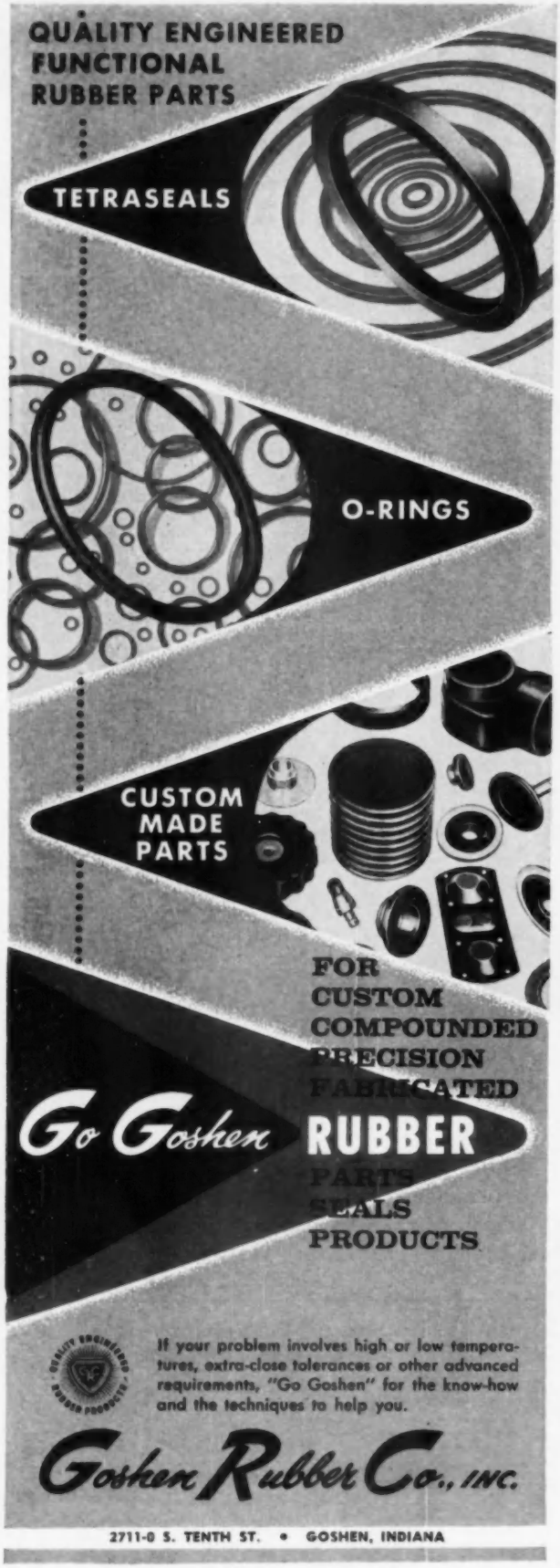
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Showing the Quality Picture . . . .
THE HISTOGRAM

(*Continued from page* 73)

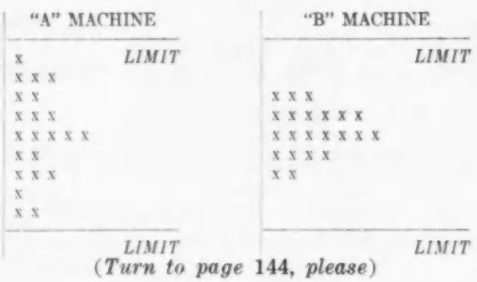
But first, we must decide where the tool is really set. Is it at −1 where we show a part, or is it at −6 where we show another part? Actually neither. It is most likely set between −3 and −4 or at −4, the average. Assuming the tool wears from the plus to minus direction, we would adjust to an average setting of +1 or in other words, move it up five units. If the first part run is within the limits, we continue to run until we have a small group of parts which will give us an average. Only then should the tool setting be changed. Just remember that any individual piece is only one from an entire normal distribution of pieces, and until we know where the average of this distribution is (roughly) we cannot realistically reset the tool. When we reset the tool we must always remember to allow for the spread of the distribution. Thus, we have three important steps to follow:

1. **run enough good pieces to establish a small histogram**
2. **find the average**
3. **find the spread**

Then use the average and spread to set the tool.

Another point we listed in the beginning, that HISTOGRAMS can tell us if a machine is capable of doing its job correctly, is a real advantage for foremen, tool set-up people, machine rebuilders, and machine builders. It is true that there are other more exact and complex methods of determining machine capability, but for the average fellow who is not a quality control engineer, the HISTOGRAM is perhaps best. To check machine capability the blueprint limits must be established and pieces run in succession without any adjustments or action by the operator. A sample of at least 30 pieces should be taken, but if this is impossible, less pieces will give fair results. After the readings have been plotted on the HISTOGRAM, the total spread should be less than the total tolerance. At Detroit Transmission, the rule of thumb we used was 70 per cent of the tolerance as the maximum acceptable spread.

HISTOGRAMS are very handy for comparing the different stations on one machine or comparing like machines. If we had two identical machines and the HISTOGRAMS looked like this:



(*Turn to page* 144, *please*)

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Aeronautics Meeting of the SAE

(*Continued from page* 126)

technology must be combined with line authority in the form of directives, procedures, and instructions that will control the actions of every purchasing, manufacturing and quality control employee.

North American Aviation's Missile Division quality control director R. F. Martin, came up with a good question:

How can unreliable humans be expected to make reliable products?

His company's program helps the shop man to identify and use scientific techniques. He is kept informed of the success or failure of his efforts toward reliability. This stimulates him to feel his constant responsibility.

Mr. Martin says we must always recognize that man is the weakest link in the reliability chain. We've been very neglectful in communicating, especially with shop people.

A formal, well-organized, aggressive "Training for Reliability" program will help a great deal, Mr. Martin believes.

New Manufacturing Techniques

Metal Removal

Chemical milling has proved an essential, economical means of metal removal in almost all modern aircraft construction.

Greatest specific application has been in sculpturing of aircraft skins to provide the highest possible strength-to-weight ratio.

Another use for chemical milling is to reduce weight in any component where the conventional means of metal forming cannot feasibly come up with the minimum thickness a particular design may call for. This applies to such metal forming operations as: casting, forging, spinning, drawing, explosive forming, and stamping.

Talking on chemical milling of advanced materials, L. B. Stearns, project manager, United States Chemical Milling Corp., pointed to the XB-70 design as the shape of things to come.

In this air vehicle, there is a complete departure from the light alloys. Construction materials are PH 15-7 Mo, titanium alloys, H-11, René 41. Typical designs in these materials place extreme demands on chemical milling.

Routine production in the light alloys is done to tolerances of ± 0.002 in. or ± 0.003 in. in addition to original stock tolerance. With the steel alloys, a total variation of ± 0.001 in. in the finished article is all that can be allowed.

The requirement is understandable. Heavier materials must be held very close to the calculated thickness or the weight variations will become too severe.

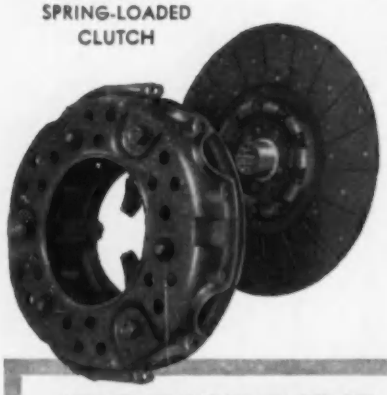
There's proof that these close tolerances can be met, Mr. Stearns reports. There's also proof that chemical milling is the only manufacturing method which can attain these tolerances and still provide a distortion-free face sheet suitable for assembly into a brazed honeycomb structure, he says.

Further in the future lies the chemical milling of refractory metals. Molybdenum, beryllium, tan-



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talum, and tungsten have been chemically milled on an experimental or prototype basis.

"It's a fact that these materials can be uniformly etched, with generally good surface finishes. So we're optimistic," Mr. Stearns says.

Noteworthy: chemical milling is probably the least hazardous method of fabricating the very toxic beryllium alloys.

R. L. Vaughn, producibility methods engineer, Lockheed Aircraft Corp., California Division, reports that ultra high speed cutting of high strength steel alloys is feasible. In experiments, metal removal rates are 240 times as great as conventional cutting. However, applying it to production machining operations is yet to be worked out.

Mr. Vaughn says several methods and applications of ultra high speed machining are in process of development. One of these is the high velocity liquid jet method. Fine abrasive particles are introduced into a high velocity liquid stream which impinges on the workpiece and rapidly disintegrates it.

Jet velocities to 7000 fps have been tested on laboratory models. Very high pressures are required to control and pinch the abrasive stream. Nozzle and liquid design have been a problem. Applications could be in routing or hole preparation.



Data Processing Mechanizes Production Control

A lively, all-day panel found top men from North American Aviation, Northrup, Ryan Aeronautical, Douglas, Chance Vought, Sundstrand-Denver, exploring this hot subject.

It was clear from the panel members and the audience that data processing has a big foot in the door in mechanizing production control.

The big question: Does it pay off? The companies vary in their approach. Some appraise a proposed system strictly on the basis of decreased flowtime and/or better control. Others weigh the cost of the system against tangible savings it will bring.

But whatever the approach, there can't be a successful installation without a master plan for mechanization. You have to make a detailed analysis of what you expect the system to do for you and what it's going to cost you.

Such an analysis needs to be done before installation.

New Manufacturing Techniques

High-Energy Forming

How to form large, complex components for missiles and space vehicles? Ryan Aeronautical says high energy forming is a good answer. The company has made many shapes and sizes: spherical pressure vessels, rocket chamber domes, and antenna reflectors.

The speed and force used in high energy forming permits very close tolerances. It minimizes springback and allows controlled thinning. As complex missile components become larger and larger, explosive forming lets us get results

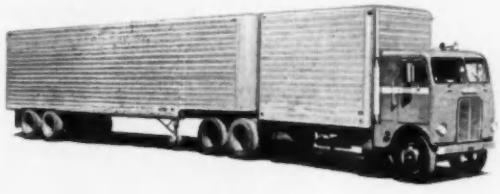


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Remember—you can *specify* the make and type of frame in the new trucks you order . . . so be sure to ask for Parish alloy steel siderails and get greater efficiency at less cost per mile!

Parish siderails are made of heat-treated, Dana-Loy 110 steel, are 277% stronger than ordinary carbon steel siderails. They're designed and built to stay straight and strong under capacity loads and uneven terrain, hence protect the vehicle against costly misalignment.

Your truck lasts longer, performs better, and costs you less to operate when it's equipped with Parish siderails. They're available through some 30 truck and trailer manufacturers—so, specify Parish siderails next time you order new equipment.



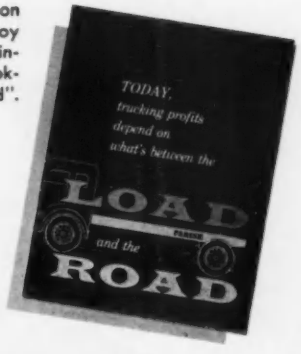


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For the complete story on Parish heat-treated alloy siderails, write for the interesting, illustrated booklet—"Load and the Road".



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we can't get with conventional methods.

Ryan reports it has explosively formed over 200 different types of parts, using refractory metals and other space age materials. In some cases, the technique eliminated heat treating; in others, it did away with complicated machining. And in some, it produced as a single unit what had been a time-consuming assembly.

Milford G. Childers, Lockheed Aircraft Corp., California Division, won this year's Wright Bros. Award. It goes to the SAE paper judged best of those presented in 1959 in the field of aerodynamics and structures.

Mr. Childers' paper was "Preliminary Design Considerations for the Structure of a Tri-Sonic Transport Aircraft."

Engineering Display

Following is a list of exhibitors at the Engineering Display held in connection with the meeting:

Adel Precision Products; Adjustable Bushing Co.; Armco Steel Corp.; Arrowhead Products Div. Federal - Mogul - Bower Bearings, Inc.; Bendix Products Div. of The Bendix Corp.; Boeing Airplane Co.; Brown-Line Corp.; A. M. Byers Co.; Chiksan Co., subsidiary of Food Machinery and Chemical Corp.

Cleveland Graphite Bronze Co. Division of Clevite Corp.; Coulter Industrial Sales Co.; Detrex Chemical Industries, Inc.; Dynamic Filters, Inc.; Eastern Rotocraft Corp.; Formsprag Co.; Garrett Corp.; General Electric Co. Aircraft Accessory Turbine Dept.; Goodyear Aircraft Corp.; Hamilton Standard Division United Aircraft Corp.; Hexcel Products, Inc.; Hi-Shear Rivet Tool Co.

Hydraulic Research & Manufacturing Co.; Janitrol Aircraft Division of Midland-Ross Corp.; Kolene Corp.; Kollsman Instrument Corp.; Koppers Co., Inc.; Le Fiell Manufacturing Co.; Lisle Corp.; Lockheed Aircraft Corp. Missiles and Space Div.; The Marquardt Corp.; The Martin Co.

Minnesota Mining & Manufacturing Co.; Nash Engineering Co.; New Departure Division General Motors Corp.; Norris-Thermador Corp.; Missiles Division of North American Aviation; Northrup Corp.; Plan Hold Corp.; Precision Sheet Metal, Inc.; Rohr Aircraft Corp.

Rosan, Inc.; Ryan Aeronautical Co.; Seaton-Wilson Manufacturing Co.; Shell Oil Co.; Shur-Lok Corp.; Stillman Rubber Co.; Stratoflex, Inc.; Stratos Division Fairchild Engine & Airplane Corp.; Sundstrand Aviation; Swedlow, Inc.; Tyce Engineering Corp.

Union Carbide Metals Co. Division of Union Carbide Corp.; U. S. Steel Corp.; Universal Cyclops Steel Corp.; Universal Match Corp. Armament Division; The Weatherhead Co.; Wesrep Corp.; Weston Hydraulics Ltd. subsidiary of Borg-Warner Corp.; Whittaker Controls Division of Telecomputing Corp.; E. B. Wiggins Oil Tool Company; Wyman-Gordon Co. ■



Digital Computers in the Design of an Experimental Army Truck

(*Continued from page* 76)

Compiler Notation	Storage Location	Description
$^{i}7$	0007	Variables 250–349 subscript for Dataplotter time
$^{i}8$	0008	Variables 350–449 subscript for Dataplotter distance
$^{i}9$	0009	Subscript for Dataplotter index
$^{y}0$ ↓ $^{y}99$	0010 ↓ 0109	Alphanumeric printout of title and column headings
$^{y}100$	0110	Tan. of slope
$^{y}101$	0111	Grade resistance, lb force
$^{y}102$	0112	Max. tractive effort
$^{y}103$	0113	Transmission rpm
$^{y}104$	0114	Velocity mph
$^{y}105$	0115	Engine rpm
$^{y}106$	0116	Transmission torque, lb-ft
$^{y}107$	0117	Engine torque, lb-ft
$^{y}108$	0118	Rolling resistance, lb/ton and lb force
$^{y}109$	0119	Wheel torque, lb-ft
$^{y}110$	0120	Tractive effort, lb force
$^{y}111$	0121	Equivalent mass, slugs
$^{y}112$	0122	Acceleration, ft/sec/sec
$^{y}113$	0123	Δt, sec
$^{y}114$	0124	t, sec
$^{y}115$	0125	Δd, ft
$^{y}116$	0126	d, ft
$^{y}117$	0127	Drawbar pull, lb force
$^{y}118$	0128	Velocity printout index
$^{y}150$ ↓ $^{y}249$	0160 ↓ 0259	Storage locations for Dataplotter velocity
$^{y}250$ ↓ $^{y}349$	0260 ↓ 0359	Storage locations for Dataplotter time
$^{y}350$ ↓ $^{y}449$	0360 ↓ 0459	Storage locations for Dataplotter distance
$^{c}0$	0461	Vehicle weight, lb
$^{c}1$	0462	Wheel radius
$^{c}2$	0463	Rear axle ratio
$^{c}3$	0464	Rear axle efficiency
$^{c}4$	0465	Coefficient of frictions, %
$^{c}5$	0466	Max. transmission speed, rpm (auto. only)
$^{c}6$	0467	Max. engine speed, rpm (std. trans. only)
$^{c}7$	0468	Engine shift speed, rpm (std. trans. only)
$^{c}8$	0469	Equiv. mass factor (1.04)
$^{c}9$	0470	ΔV, mph
$^{c}10$	0471	Gear shift time, sec (std. trans. only)
$^{c}11$	0472	Trans. decision (1 for auto, 0 for std.)
$^{c}12$	0473	Printout interval, mph
$^{c}13$	0474	Maximum time, sec (Dataplotter constant)
$^{c}14$	0475	Maximum velocity, mph Dataplotter Constants
$^{c}15$	0476	Maximum distance, ft
$^{c}16$	0477	Tire slip, %
$^{c}17$	0478	Coefficient of air resistance, lb, sec^2 ft^4
$^{c}18$	0479	Projected frontal area, ft^2
$^{c}19$	0480	Transfer case efficiency
$^{c}i1$	0501–0520	Grade, % slope
$^{c}i2$	0521–0540	rpm for shift to next gear (auto. only)
$^{c}80$	0541	Transmission ratio
$^{c}89$	0550	

(*Turn to page* 136, *please*)

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RINGS IN THE INDUSTRY

Digital Computers

(*Continued from page* 135)

Compiler Notation	Storage Location	Description
*90	0551	Std. transmission only, corres. efficiency for above gear ratios
*99	0560	
*100	0561	Std. trans.—engine speed, rpm Auto. trans.—trans. speed, rpm
*119	0580	
*120	0581	Std. trans.—corres. eng. torque, lb-ft Auto. trans.—corres. trans torque, lb-ft
*139	0600	
*140	0601	Auto. trans. only—corres eng. speed
*159	0620	

Plan Work Transfer

Electric Autolite Co. said it will transfer production of starting motors and generators from its Toledo, O., plant to the Bay City, Mich., plant.

The move, Autolite said, will add 600 jobs at Bay City. A United Auto Workers local there recently voted to take an incentive pay cut to keep the plant open.

Autolite said it is shifting the work because of the "changing economic situation." Autolite, which is building a plant at Decatur, Ala., has indicated it plans to end all production at Toledo.

PONTIAC TEMPEST

(*Continued from page* 58)

casting for proper locating on the transfer mechanism in the Ingersoll machines. When the single-bank block is scheduled, the foreman operates a single key switch which cuts out one bank of boring tools on the cylinder boring heads. Obviously, when the line returns to V-8 machining the left bank boring heads are cut in to cycle.

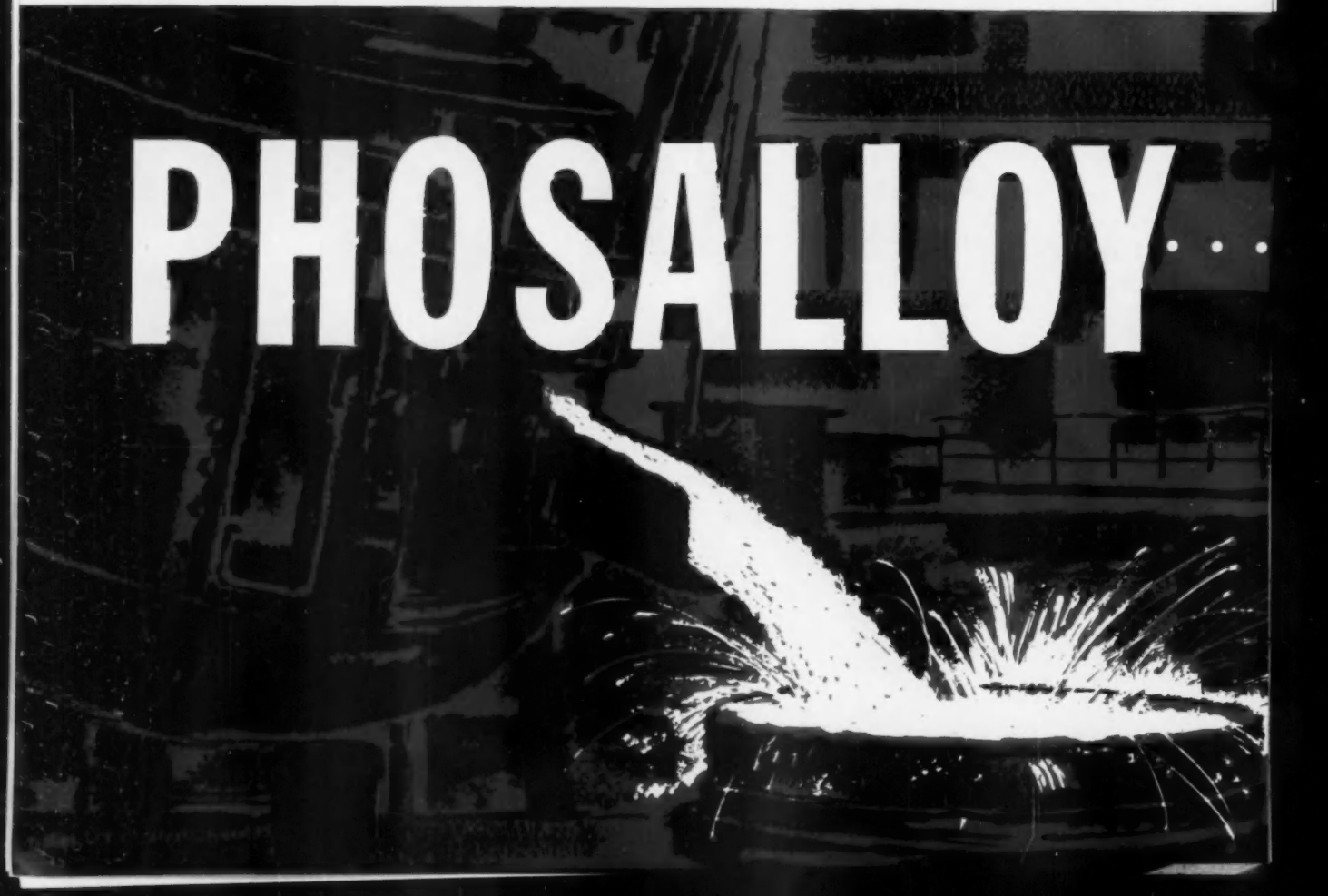
Beyond this point on the Ingersoll line, it was necessary to add one station to take care of a special milling operation on the 4-cylinder block. In the case of drilling and tapping heads some stations require more or less tools for the 4-cylinder block, necessitating a change-over for each type of block.

Greenlee transfer machines were treated in exactly the same manner, namely leaving one line exclusively for the V-8, adjusting the other line to take both blocks.

However, when it came to pan rail drilling on the Greenlee, it became necessary to make some special arrangements to support and balance the 4-cylinder block due to the elimination of one bank. This was solved by Greenlee by the addition of special stripper plates and clamps on the LH bank side to hold the block securely. On the Greenlee line, too, it was necessary to add several new heads to take care of engineering changes on both blocks.

Cylinder bank drilling on the Greenlee is taken care of by the introduction of a key-operated cut-out switch which idles the heads for the LH bank. At the end of

(*Turn to page* 138, *please*)



Observations

By Joseph Geschelin

New Car Materials

According to Chrysler the usage of aluminum has grown to an average of 65 lb per car, in some 52 detail parts. Plastic applications are growing too at Chrysler. Latest is a large radio speaker grille of polypropylene formulation in a variety of colors.

Leaf Springs

Although many makes of cars, particularly in the GM family, employ coil springs in the rear suspension, there still remains a large volume of leaf springs for other makes of cars and for trucks. We understand that one of the major steel companies has revived the project of producing a single-leaf spring by a special rolling process. While this is an expensive project, it will solve some problems that have been troublesome in the past and may be instrumental in keeping leaf springs on the job.

Fan Loss

One of our good friends has been trying for some time to find out what it takes to cool the Volkswagen engine. The figures have been difficult to obtain but he got them and here they are:

Engine RPM	Fan Loss HP.	Losses (HP.) (Fan, Generator, Belt)
1000	0.4	0.65
2000	1.1	1.65
3000	2.4	3.25
3500	3.4	4.4

It just goes to show you can't get something for nothing. That is to say, it takes power to air cool.

Small Engines

Several leading producers of two-stroke outboard motors testified recently that they are experiencing unusually short spark plug life due to plug fouling. When we say short life, we refer to a life of but 40 hours at best. Engineers and service people discussing this problem say that trouble-free performance could be practically guaranteed if white gasoline (TEL-free) were made available in the various areas where motor boating is concentrated. Up to now this has been difficult to handle by the large marketers. But the outboard field is growing enormously. For example, it is estimated that in 1959 (figures not yet available for 1960) some 540,000 outboard motors were produced. The population of outboard motors is estimated at close to six-million units. This group consumed 22-million gallons of lubricating oil and 440-million gal-

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lons of gasoline last year. If you add to these numbers the millions of single-cylinder engines, two- and four-stroke, you can come up with a fantastic figure of requirements for special lubes and fuel. We are sure that some marketers will find this an important and profitable business. ■

PONTIAC TEMPEST

(*Continued from page* 136)

the Greenlee line a new head was added to take care of the 4-cylinder block. This was easy to do since the machine had ample provision for additional heads.

On the finishing section of the line where Ingersoll equipment is employed for cylinder boring, cam-and-crank boring, and associated operations, one section was rewired to make possible complete intermixing of blocks or running them in batches. Honing operations were treated in the same way —complete mix or either 4-cylinder or V-8. In each instance, Pontiac has installed limited switches within the station and just outside the station to cut out one bank of boring tools or hones when the message is sent through by a single-bank block.

Toward the end of the Ingersoll transfer line there is a station at which milling is done on both sides of the block. At this point Pontiac has installed an additional head with a heavy saw to cut off a heavy lug on the LH side of the 4-cylinder block.

It is obvious from the foregoing that cooperative action among engineering manufacturing, and the machine tool builders, coupled with advance planning made it possible to convert the block line with the minimum of effort and cost. Moreover, wherever changeover has to be made, this is done in the most economical fashion. In fact, we were told that the total time for a changeover from one block to another on the single line requires but 45 minutes.

This is most significant in a large volume operation since it implies that a complete changeover of the line could be effected, in an emergency, during the course of a working shift. ■

Gasket engineering

SEALING LIGHT FLANGES

Lightweight stamped or cast flanges often do not provide uniform compression on gaskets . . . and leaks result. Here's how a simple design change solved this problem and reduced gasket costs as well.

E. M. SMOLEY
Research Physicist
Armstrong Research and Development Center

There is an obvious cost advantage to using a lightweight stamped or cast flange wherever possible. Such flanges can, however, complicate the gasket problem. They usually are not rigid enough to distribute bolt loads evenly on the gasket. As a result, the flanges tend to bend or bow, reducing flange pressure on the gasket between the bolts and permitting leakage.

A typical problem of this type—the cast cover flange of a household gas meter—was recently referred to the Armstrong Research and Development Center. The outline of the flange and the distribution of the bolts are shown in Figure 1. The flange was gasketed with ⅛" material, and flange bowing was suspected as the cause of troublesome leaks in the meter.

To measure the distribution of the bolt load around the flange, engineers used the Armstrong-developed "solder-plug" test. In this test, tiny plugs of solder are placed in holes drilled in the gasket where the degree of gasket compression is to be measured (see Figure 1).

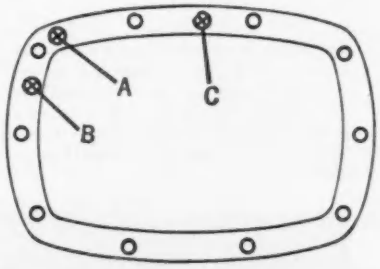


Figure 1. Diagram of the flange gasket indicating bolt spacing. Note bolts are farther apart on the sides than on the ends. Solder plugs were inserted at points A (beside bolt), B (midway between — short span), and C (midway between — long span).

Then the unit is assembled and bolts tightened—flattening the solder plugs. When the flange is opened, the thickness of the flattened plugs reveals exactly how much the gasket was compressed at each test point.

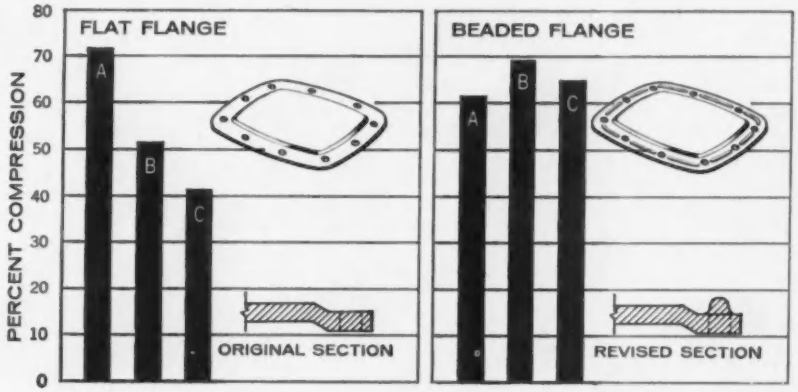


Figure 2. This shows the results of the solder-plug test on the original flange. Outline of the flange and sections is shown at right.

Figure 3. Results of the solder-plug test on the redesigned flange. Note how the bead (see section at right) improved distribution of flange load.

Figure 2 shows the results of this test on the gas meter flange. Note the difference of almost 31% between the minimum and maximum compressions on the gasket. Leakage occurred on this assembly because the flange at point "C" actually did not produce enough load to develop a seal with the gasket material being used.

Armstrong engineers suggested that the manufacturer modify his cover plate to incorporate a rib or bead along the flange between the bolts.

This change required only a minor modification of the forming tool and did not involve any increase in the cost of the finished part. The beads stiffened the flange sufficiently to provide much more uniform distribution of the bolt load.

This was proved by a second solder-plug test, the results of which are shown in Figure 3. With the beaded flange, the maximum variation in gasket compression is only 8.3%.

Not only did the new flange design stop the leaks, but it also allowed a reduction of 50% in the gauge of the gasket. A 1/16" Armstrong cork-and-rubber gasket seals the new flange.

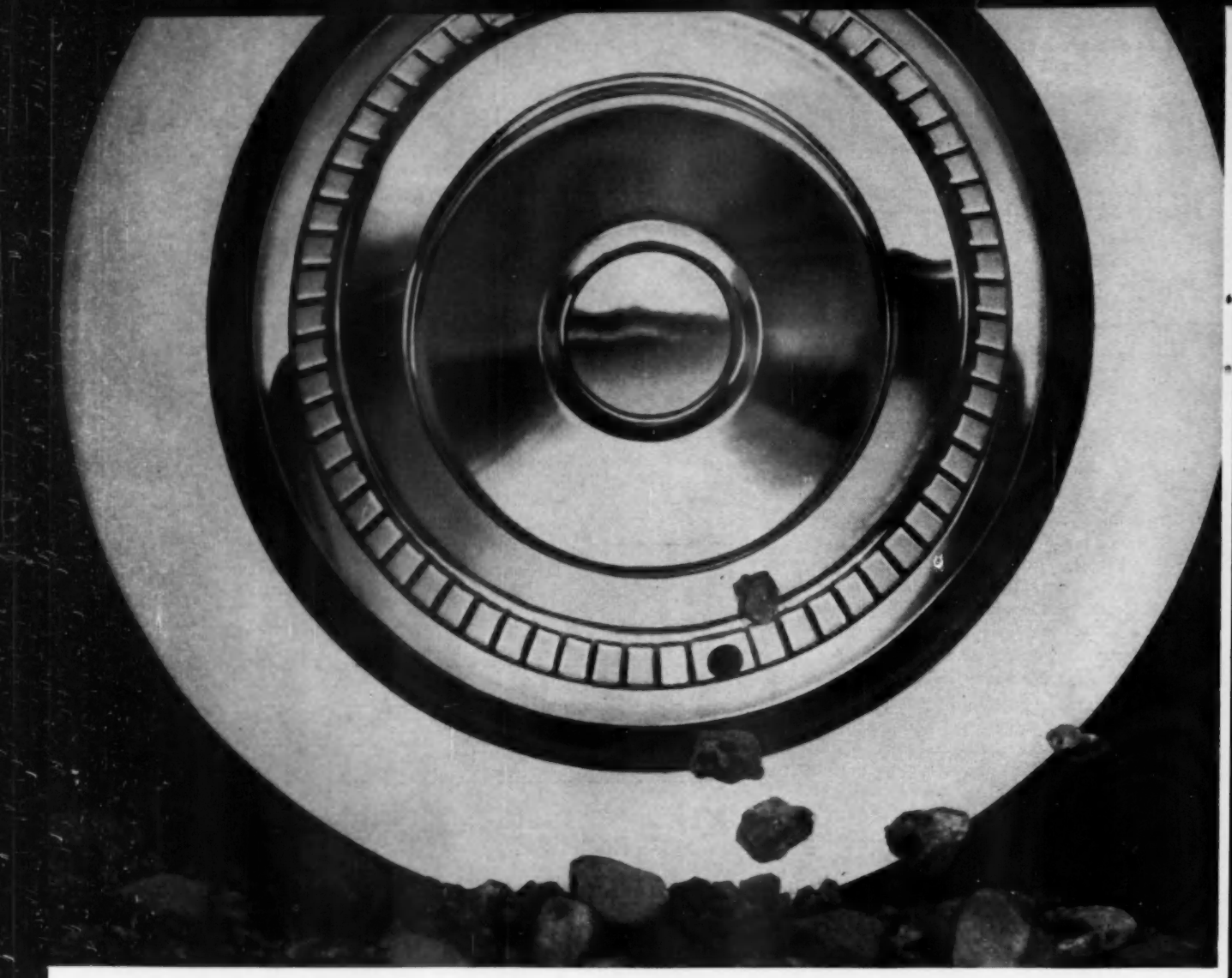
If you have a problem with a lightweight flange, or an application where a lightweight flange could save you money, perhaps our gasket engineering experience can be of help.

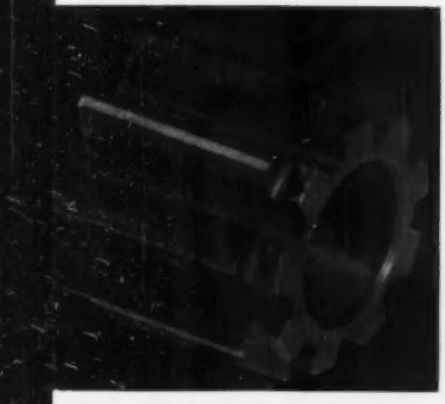
We will be glad to make suggestions if you will send details of the application to us. And if you do not already have a copy of the Armstrong Gasket Design Manual, we will be glad to send you one. Write Armstrong Cork Company, Industrial Division, 7112 Imperial Ave., Lancaster, Pennsylvania.



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1860-1960 Beginning our second century of progress

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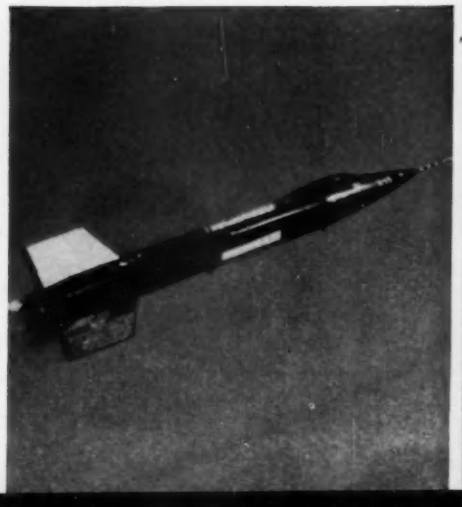


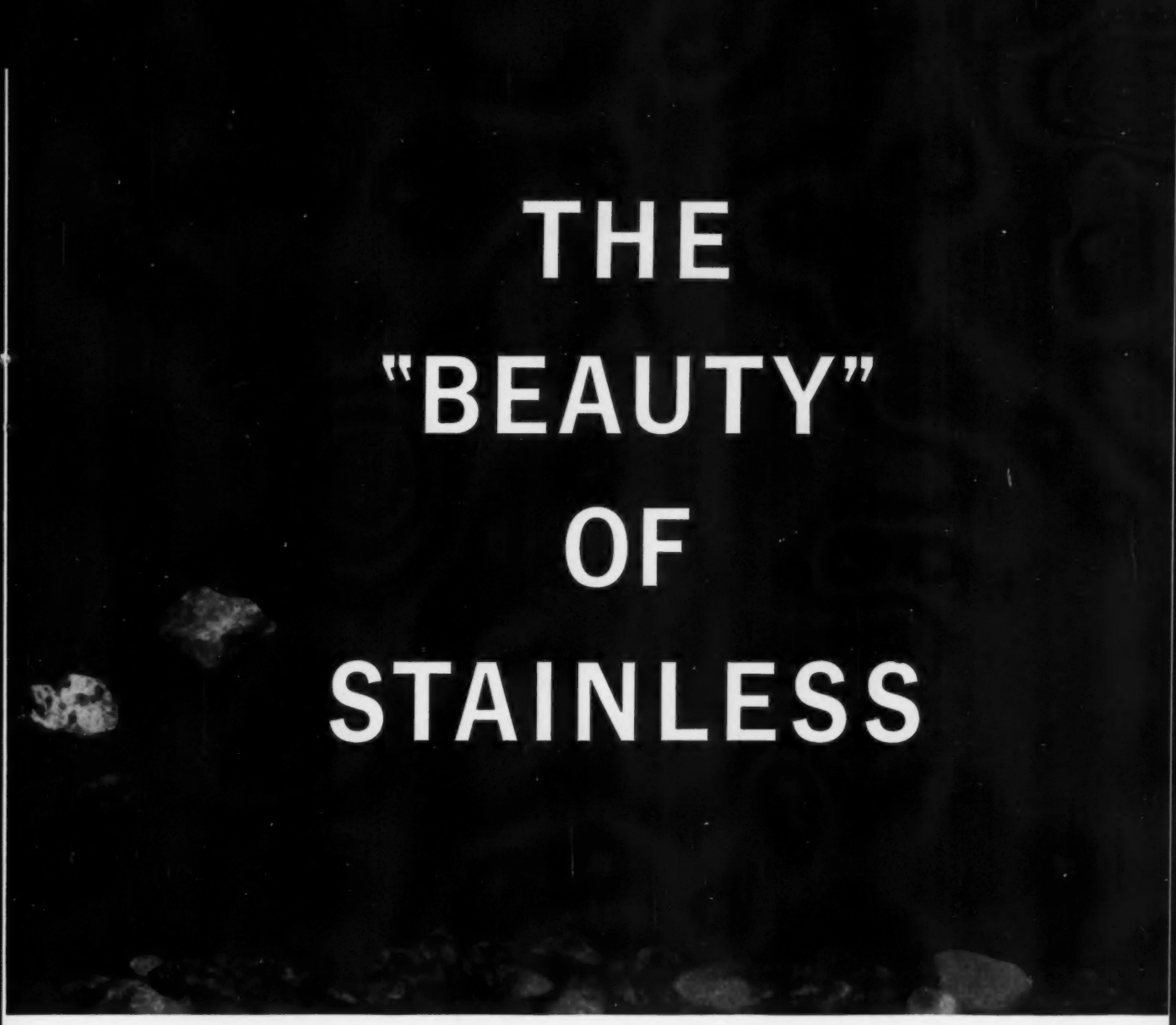
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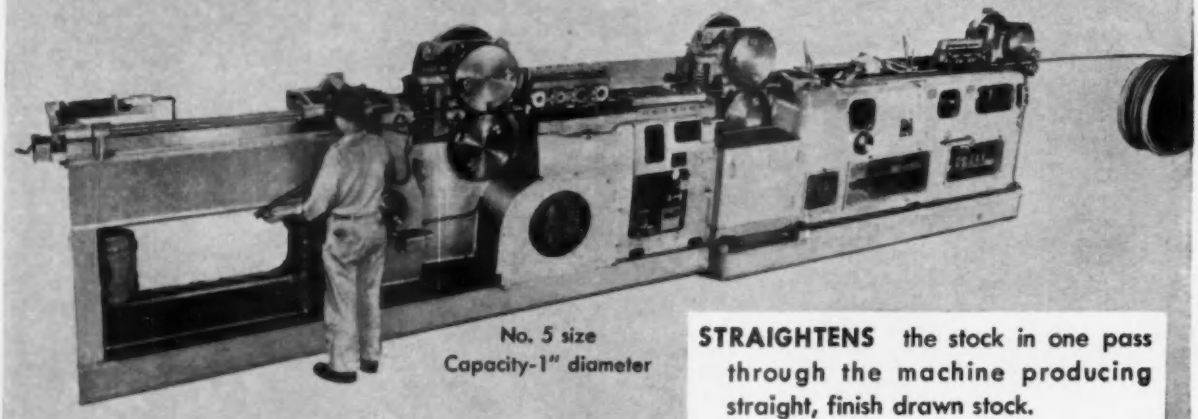
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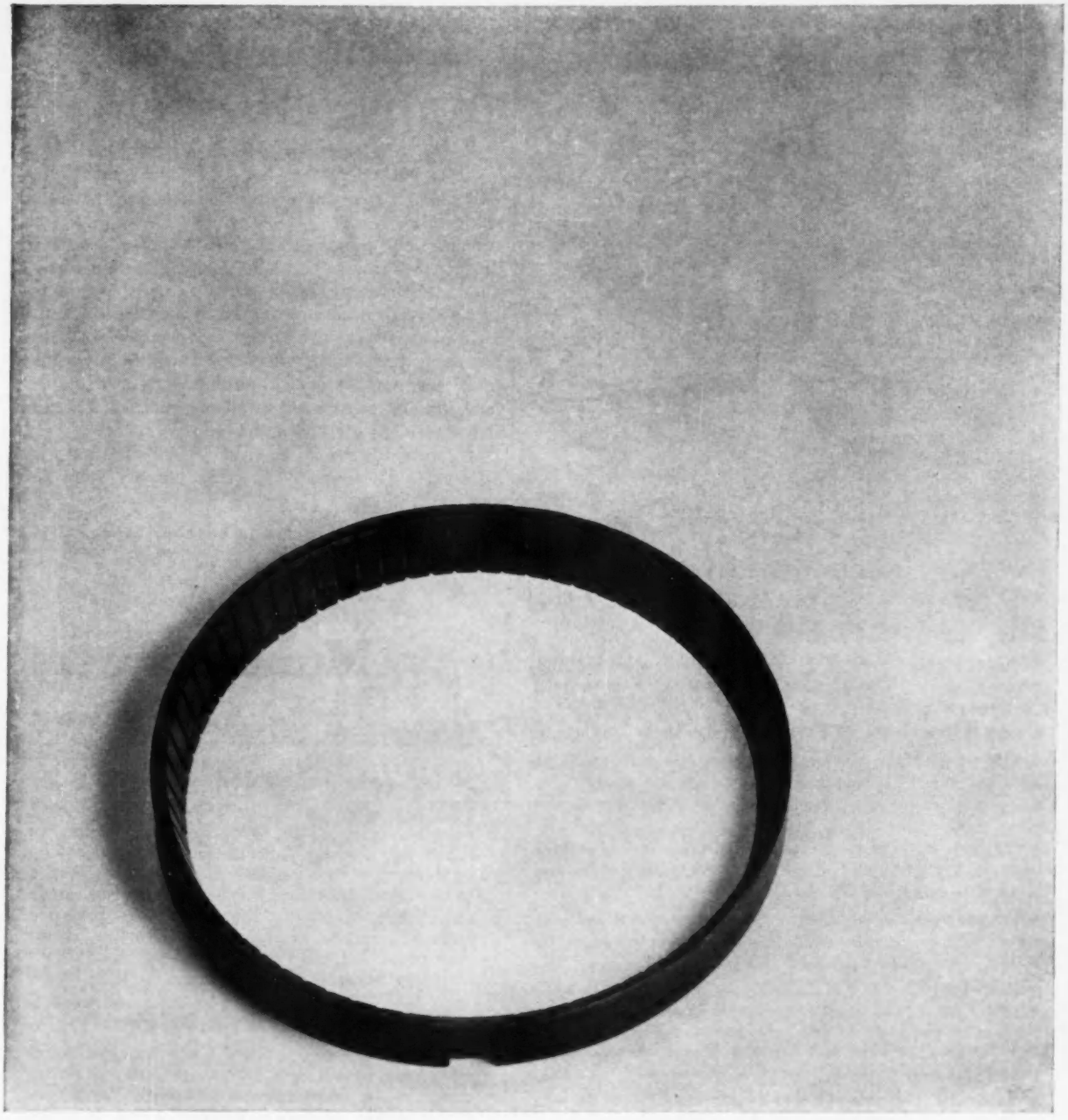
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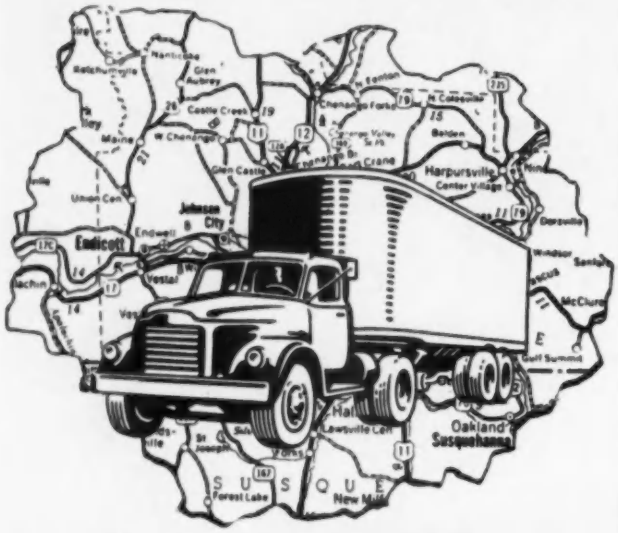
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(*Continued from page* 128)

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The foregoing is from the 15th Annual Forum of The American Society for Quality Control, Greater Detroit Section, held at Detroit Sept. 10, 1960



Manufacturers' News

Hiller Vote Scheduled

Stockholders of Hiller Aircraft Corp. will vote on Nov. 22 on proposed acquisition of Hiller by Electric Autolite Co. Autolite stockholders will vote on the plan Nov. 17. Terms of the acquisition call for Autolite to exchange one share of outstanding common stock for each 4¼ shares of Hiller. J. T. Dresher, Hiller vice president, said the acquisition will allow Hiller to finance new programs.

Allegheny Ludlum Eyes Belgium

Allegheny Ludlum Steel Corp. has announced plans to set up, along with two Belgian concerns, a company to make and sell specialty steels for European and world markets. The new company, in which Allegheny Ludlum will have a half interest, plans a stainless and specialty steel plant in Belgium. The partner firms are Societe Anonyme Metallurgique d'Esperance-Longdoz, of Liege, Belgium, and its parent concern, Evence Coppee & Cie.

Machine Tool Firm Acquired

Canadian Fairbanks-Morse Co., Ltd., has acquired Rudel Machinery Co., Ltd., a distributor of machine tools. Rudel will continue under its present management. John M. Rudel, president of the acquired concern, will become a vice president and director of Canadian Fairbanks-Morse. In addition to machine tools, Canadian Fairbanks-Morse sells engines, electric motors, pumps and scales, railway equipment and consumer products.

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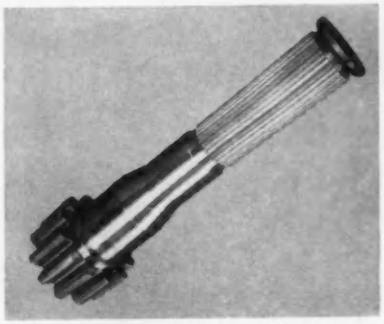
STEEL SERVICE CENTER INSTITUTE



Holding the Shippingport nuclear reactor's top head to its shell section is a job performed by 42 studs of AISI 4340. This through-hardening nickel steel provides essential strength and toughness.



Power-packed tractor features unique drive mechanism composed of regular gear transmission, clutch and torque converter with lock-up, utilizes nickel alloy steels in more than 25 components.



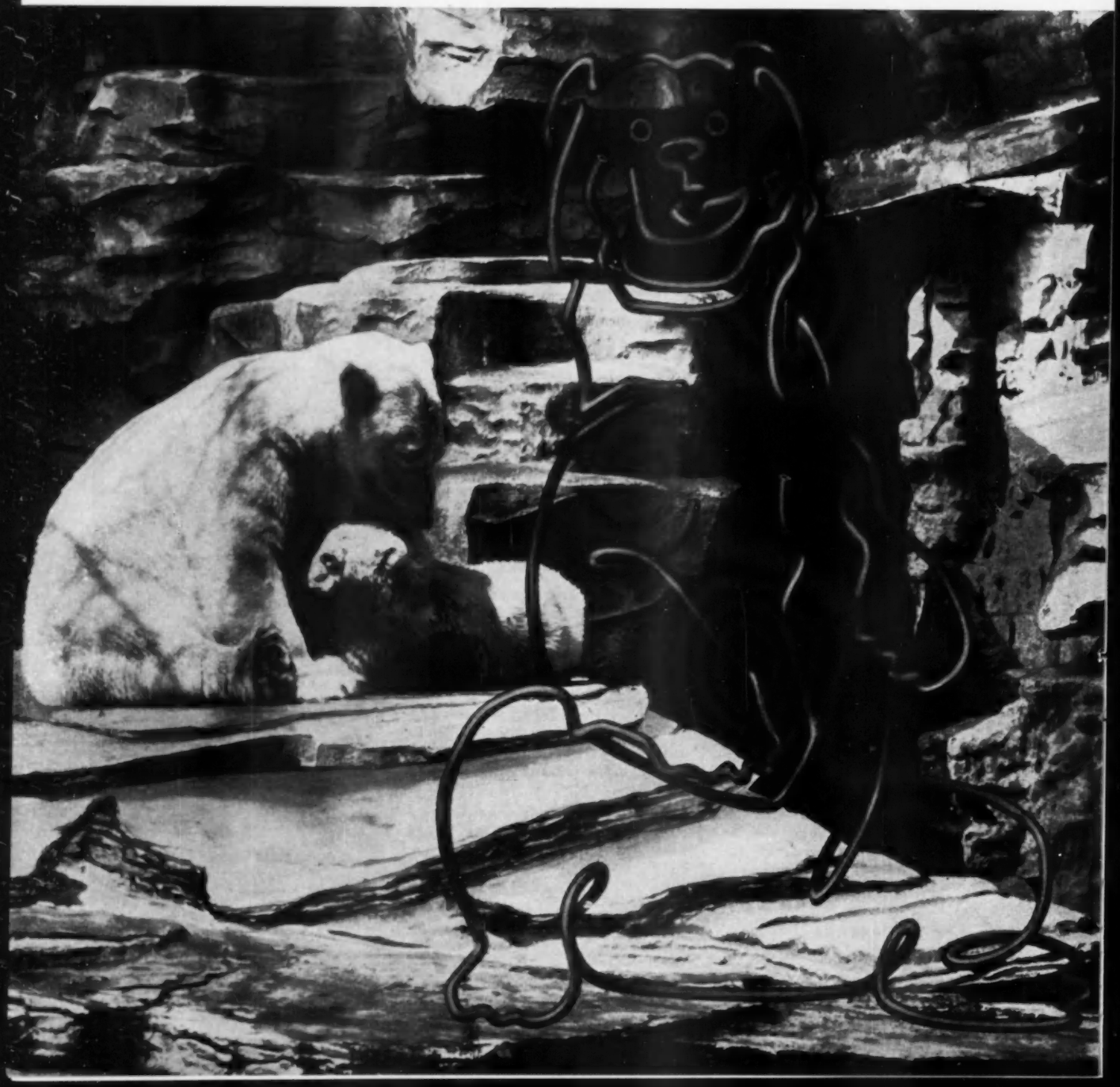
Swing shaft for giant power shovel made from 4340 nickel alloy steel for strength and toughness to take shock-loading in stride. This 9″-diameter, 36″-long shaft of 4340 nickel alloy steel transmits tremendous torque to a giant ring gear.



Sustained accuracy is assured in this heavy-duty milling machine by spindle and gear components of AISI 4340 and 4620 nickel alloy steels. They provide needed strength and wear resistance.

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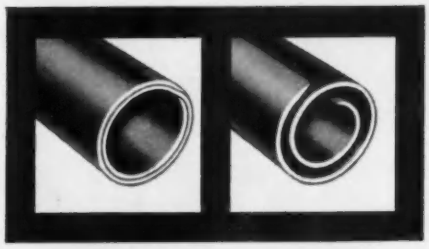
Bundy can mass-fabricate practically anything



Complex or simple, your tubing components need precision bending to fit right on your production line. Bundy turns out parts like the air-conditioner condenser coil shown below by the thousands. And Bundy can fabricate tight bends in the connecting lines between the condenser, evaporator, temperature regulation valve and discharge tube from Bundyweld®, too. This is the tubing that has long been accepted as the safety standard of the automotive and refrigeration industries. Meets ASTM 254; Govt. Spec. MIL-T-3520, Type III. When you need tubing, phone, write or wire: Bundy Tubing Company, Detroit 14, Michigan.

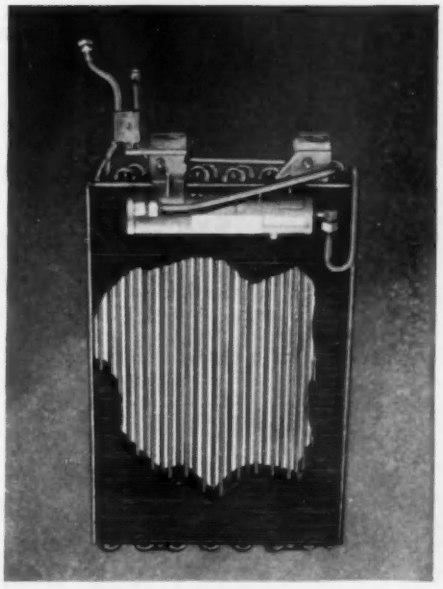
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World's largest producer of small-diameter tubing. Affiliated plants in Australia, Brazil, England, France, Germany, Italy, Japan.



Bundyweld, double-walled from a single copper-plated steel strip, is metallurgically bonded through 360° of wall contact. It is lightweight and easily fabricated . . . has remarkably high bursting and fatigue strengths. Sizes available up to ⅝" O.D.





The condenser coil and connecting tubes of this air conditioner supplied to Ford by the McCord Corp. are made from Bundyweld steel tubing. Double-walled Bundyweld provides leakproof dependability and important cost savings.

BUNDYWELD® TUBING

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Send your sample parts for free deburring in Almco's Lab

Here in the world's most complete barrel finishing laboratory, your deburring and finishing problems can be studied by ALMCO's team of experts *at no obligation*. ALMCO has helped many firms reduce these costs *by more than 90%*.

Your sample parts are processed with the latest ALMCO Supersheen barrel finishing equipment . . . the identical units you can get for your own plant, large or small. The final ALMCO report to you is factual and complete in every detail. It may mean big savings to you.

WRITE TODAY on company letterhead, asking for ALMCO Sales Engineer to arrange for sample processing. Or send sample parts along, with specifications on results desired. (If possible include finished part for guide.) Mail to *Harold Mickelson*, Chief Engineer, ALMCO Test Lab., Queen Products, Inc., 2611 E. Main St., Albert Lea, Minnesota. Subsidiary of King-Seeley Corp.

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Popular package is 8-oz. can fitted with Bakelite cap holding soft-hair brush for applying right at bench; metal surface ready for layout in a few minutes. The dark blue background makes the scribed lines show up in sharp relief, prevents metal glare. Increases efficiency and accuracy.

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THE DYKEM COMPANY
2301-L North 11th St. • St. Louis 6, Mo.

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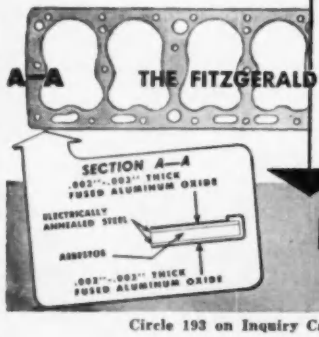
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A—A THE FITZGERALD MANUFACTURING CO.
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END NIGHT CLEANUP & MORNING REBLUING



DYKEM HI-SPOT BLUE No. 107 is used to locate high spots when scraping bearing surfaces. As it does not dry, it remains in condition on work indefinitely, saving scraper's time. Intensely blue, smooth paste spreads thin, transfers clearly. No grit; noninjurious to metal. Uniform. Available in collapsible tubes of three sizes. Order from your supplier. Write for free sample tube on company letterhead.

THE DYKEM CO., 2301-L NORTH 11TH ST., ST. LOUIS 6, MO.

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covering the issues from January 1 to June 15, 1960, inclusive

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By C. J. Kelly
ASSISTANT EDITOR

Caculator Card 1

A handy, pocket size card is available for determining the surface speed of both buffing and polishing wheels. The 3 by 5 in. calculator gives easy-to-use instructions on how to find the surface speed, in feet per minute, of any wheel from 1 to 60 in. in diameter, turning at spindle speeds from 200 to 20,000 rpm. *Hanson-Van Winkle-Munning Co.*

Clamp Booklet 2

Catalog 31 includes full scale tracing templates of jig and fixture components and over three hundred clamping items. Numerous charts and illustrations are given along with technical material and specifications. *Northwestern Tools, Inc.*

Cylinder Data 3

Five specification sheets that cover double acting twin cylinders are offered. They contain line drawings, technical information and the various operating characteristics of the line. Charts show engineering data and dimentions. *Owatonna Tool Co.*

Application Booklet 4

Gear pumps, control valves, and motors, and their application on mobile equipment and production machinery, are the subjects of a new general bulletin just released. In addition to providing comprehensive performance data on the complete line of Hydreco products, the new eight page bulletin contains photographs and cutaway drawings illustrating the construction and design features of each of the various components. *Hydreco Div. of The New York Air Brake Co.*

Line Catalog 5

Catalog 23103 describes and illustrates company's complete line of mechanical power transmission equipment. Products covered include variable speed drives of both motion and stationary control types; conventional v-belt and ultra-V belt drives; timing belt drives; flat belt pulleys, flexible and rigid couplings; adjustable motor bases; ball bearing pillow blocks, flange and take-up units; solid and split sleeve pillow blocks; cotton-card drives; cotton cleaner drives; bushings. *T. B. Wood's Sons Co.*

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By C. J. Kelly
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Automatic Machines 6

A series of line drawings shows all the important dimensions and working clearances for automatic nailing and screwdriving machines. Designed to help the engineer or designer in the layout of workable clearances, the drawings clearly illustrate hand and finger clearances, as well as those for the machine parts, on the various models of the portable automatic Powasert nailers and the air-driven screwdriver gun. *United Show Machinery Corp., Industrial Machinery Div.*

Welding Alloy Catalog & Instruction Manual 7

An entirely new 56-page welding, brazing and soldering alloy and flux Catalog and Instruction Manual is offered free of charge. The pocket-size manual is also offered in Spanish on written request. Physical properties, major uses, detailed application instructions and the latest techniques for welding, brazing, soldering, cutting and hardfacing are included for a wide line of products for joining all commercial metals. Helpful charts and tables summarize alloy selection and properties. Products are indexed by major metal use. Practical short-cuts, helpful hints, chemical composition and data on automatic and semi-automatic welding wire are given. Manual welding, brazing, soldering, cutting and tinning instructions are included. *All-State Welding Alloys Co., Inc.*

Feed Units 8

A four page brochure details a new concept in way type feed units. All given dimentions are to the industry's special machine tool standards. Complete specifications are also included. *Buhr Machine Tool Co.*

Couplings 9

Two new types of para-flex cushion couplings, one for high speed, high torque applications and another for attachment to flywheels of internal combustion engines, are described in a new 20-page bulletin. Complete engineering data, photographs, dimension drawings and selection tables cover the new high speed and flywheel couplings as well as the original standard para-flex. *Dodge Mfg. Corp.*

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Comparison Chart 10

A quick informational reference for engineers in search of high-temperature insulation materials for electrical, electronic, avionic and nuclear applications has been issued. It contains a completely revised, up to date engineering chart which details the most commonly used plastic and ceramic materials. The four page leaflet also includes a listing of the fahrenheit temperature limits for 88 materials, and also a table of thermal expansion coefficients of 57 widely used insert metals and insulating materials. *Mycalex Corp. of America.*

Engineering Bulletins 11

Engineering bulletin 5903-1 covers a complete line of "Dodo" electronic time delay relays, offering time delay periods from 0.020 to 300 seconds, with delay-on-drop-out. Included are complete specifications and a selection guide of available types, as well as special variations available on special order. The second release, Bulletin 5903-2, describes a line of AC operated electronic time delay relays. Also included are complete specifications and a standard type selection guide. *Tempo Instrument Inc.*

Flexible Shaft 12

The completely revised fourth edition of a fact-packed, flexible shaft handbook is now available at no cost to design engineers and users of flexible shafts. A simplified approach to the selection of flexible shafting through Standard, Pre-engineered, or Custom-designed flexible shafts is featured among the new data in the handbook. Copious descriptive material, charts, tables and drawings are provided to aid the designer in this selection. *S. S. White Industrial Div.*

Single Shaft Turbine 13

New bulletin 198 describes a recently introduced 9000 hp single shaft gas turbine. Primary designs and high reliability are first discussed, followed by a detailed description of major components. Pictures, illustrations and diagrams highly important features such as the compact turbine rotor supported in two journal bearings, multi-stage axial compressor, three stage turbine, special cooling of turbine discs and blade roots, single combustion chamber with two parallel burners, highly accessible, split-shell bearings, and labyrinth type seals of honeycomb construction. Both liquid and gaseous fuel systems are detailed along with descriptions of the controls, protective devices and lubricating system. *Clark Bros. Co.*

Commercial Glass 14

A booklet which details properties of 32 commercial glasses has been published for the use of engineers, designers and other technical personnel. The 16-page booklet contains information on several new glasses as well as new sections on thermal expansion and optical properties. It also offers a temperature chart for converting fahrenheit degrees to centigrade degrees and centigrade to fahrenheit. Other sections cover thermal stress, heat transmission, electrical properties, corrosion resistance and viscosity data. Several charts and graphs are included. Please request on company letterhead from *Corning Glass Works, Corning, N. Y.*

Spring Fasteners 15

Standard and special spring fasteners in twin-prong or cone type impressions and push-on types are illustrated in a thirteen page catalog. Data is arranged so that selection of fastener by style, screw or stud size is easily made. Information concerning tensile and torque and other pertinent design requirements is provided. *George K. Garrett Co., Inc.*

Spring Data 16

A new 12-page booklet shows a line of flat spiral power springs including two variations of a new spring design. The booklet illustrates and describes four Spring types: Spiral, Crosscurved, Stainless and Integral Band with and without bridle. Information is given on applications of the various spring types as well as on specific examples of spring problems which have been solved by spring engineering and design service. The booklet provides reference data on spring nomenclature, various types of ends and centers and lists data required when ordering springs. *Sandvik Steel, Inc.*

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Tubular Products 17

Those associated with the design, manufacture or purchase of equipment involving the high temperature application of tubular products will be interested in a new brochure. This six page folder, called T-467, contains information on 15 steels which are widely used in high temperature service. Included is a chart showing information on tensile properties, thermal conductivity and expansion, creep strength, oxidation resistance and other such physical and mechanical properties of importance to application engineers. *The Babcock & Wilcox Co., Tubular Product Div.*

Towing Tractors 18

A four-page, two-color bulletin (SS-1286) describes towing tractors of 22,500 and 30,000 lbs drawbar pull has been published. Shown are details and engineering specifications on the Clarktor 225 and 300, which were designed primarily for towing large jet aircraft but can be used wherever extremely heavy loads must be moved horizontally. A performance profile chart based on grades, speeds and drawbar pull is included along with specifications of engine, transmission, electrical system, instruments, brakes and steering arrangement. *Industrial Truck Div., Clark Equipment Co.*

Die Casting Machines 19

A new 12-page bulletin describes complete line of high pressure hydraulic die casting machines, 100, 250, 400, 650, 850, 1000 and 2000 ton models. Details are included on such advanced optional features as machine automation and vacuum die casting. *The Cleveland Automatic Machine Co.*

Universal Joints

A publication of 66 pages contains engineering information which is intended for use in practical application of universal joints and does not delve into the more theoretical aspects of the cardan joint. Line drawings, illustrations and charts are given for easy reference. Please request on company letterhead to: *Mechanics Universal Joint Div., Borg-Warner Corp., 2020 Harrison Ave., Rockford, Ill.*

Adhesives Data

A new 12-page catalog, A-ZBD-102-JR, containing 8 fold-out tables listing the uses, characteristics and general properties of over 170 different adhesives, coatings and sealers can be obtained by writing on company letterhead to: *G. W. Crain, Adhesives, Coatings and Sealers Div., Minnesota Mining & Mfg. Co., 900 Bush Ave., St. Paul 6, Minn.*

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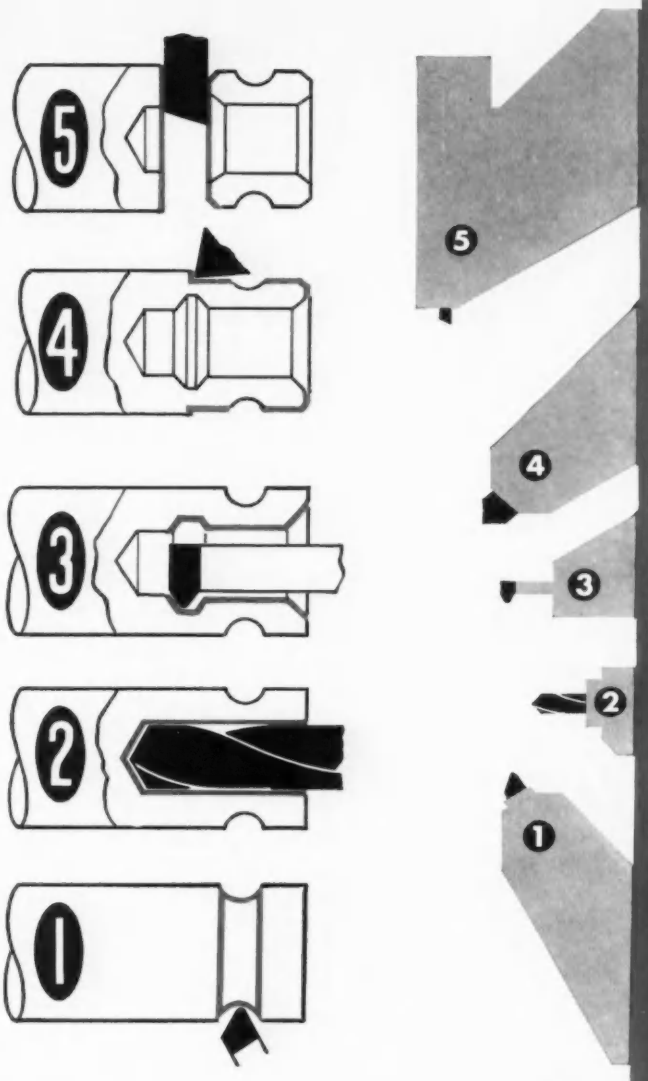
STANDARD STYLE 308 BORES AND CONTOURS MINIATURE BEARING RACES FROM BAR STOCK

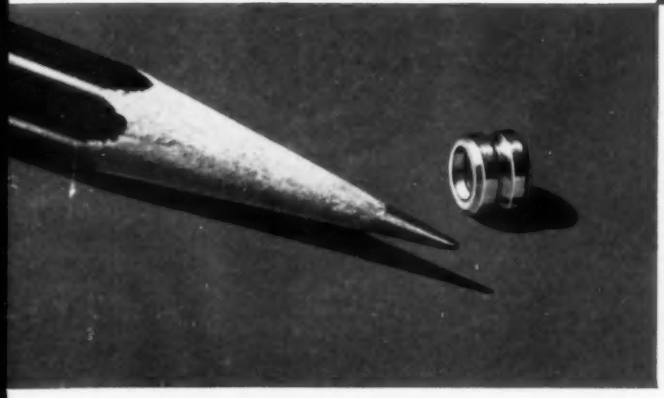
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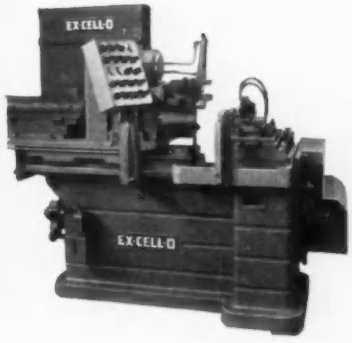
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ABOVE: Operations are (1) generate track, (2) drill, (3) back chamfer and contour bore I.D., (4) face, chamfer and turn O.D., (5) chamfer O.D. and cut-off. LEFT: Style 308 Cam Boring Machine. FAR LEFT: Part (shown 2½ times actual size) is 440C stainless steel. Tolerance is held to plus or minus .00025", finish to 20 RMS.

60-28

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